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THE GENERAL ELECTRIC REPORT.

We give elsewhere an abstract of the figures of the annual report of the General Electric Company, received as we go to press. This sixteenth report is, all things considered, a most encouraging document, for it shows the company to have weathered the fierce storm of last October with a success in notable contrast to the disasters in which it became involved during the bad times of 1893-7. The statistics of business done are impressive—orders of $59,000,000; sales billed of over $70,000,000; earnings of over $72,000,000. Moreover, as against obligations of $80,000,000 in stock and debentures, the company shows firm assets of $98,000,000, with patents, franchises and good will valued at one dollar. It is interesting to note that sales have gained over 19 per cent annually for 10 years past. Hence, while they may not do so this "off" year, there is no reason to doubt that the rate will be maintained, although it becomes, of course, increasingly more difficult as the vast totals grow. In this connection it may be noted that the company holds its own, for the general growth of electrical business of all kinds throughout the country seems to have averaged 15 to 20 per cent annually for the last two decades. The variety of product and the increasing size of units are emphasized in this report, so commendable in its fulness and frankness of statement, and we cannot but congratulate the management upon the record of these results achieved under such conditions as have lately darkened the skies of all American industries.

INSTRUMENTS AND METHODS OF RADIOMETRY.

The last number of the *Bulletin* of the Bureau of Standards contains an extended paper on a comparative study of the different instruments employed in the measurement of radiant energy. There are five such instruments, all but one electrical or involving electricity, namely, the microradiometer, the radiomicrometer, the radiometer, the thermopile and the bolometer. The microradiometer is virtually a differential air-thermometer, with a small tube connecting two large air-bulbs, one of which is exposed to the radiation examined. The connecting tube contains a drop of mercury and columns of zinc sulphate solution. A Wheatstone bridge balance of the resistance in these columns enables minute displacements of air to be determined. This instrument is, however, regarded as the least sensitive of all. The radiomicrometer consists of a single delicately suspended loop of wire forming a closed D'Arsonval galvanometer coil, and containing two thermo-electric junctions, one of which is exposed to the observed radiation. Temperature elevations of one millionth of one degree Centigrade, or even less, can, it is said, be detected by this instrument. The radiometer was devised by Crookes and has been developed in recent researches. It consists essentially of a pair of small vanes suspended by a quartz fiber in

a vessel containing gas at a low pressure. One of the vanes being exposed to radiation, tends to rotate the suspended system. A sensitiveness of one millionth of a degree is also claimed for this instrument, which is not electrical. The microthermopile is the best known of all the instruments used in measuring radiation, and was the earliest to be employed for that purpose. It requires a very sensitive galvanometer for its best work, and also responds to about one millionth of a degree. The bolometer consists essentially of a very thin strip of metal which changes its temperature when exposed to radiation, and, by a correspondingly small change in resistance, enables the change in temperature to be rendered evident. A sensitiveness of a millionth of a degree is also claimed for this instrument.

It is pointed out that the degree of sensibility that can be reached, in practice, for each of the four instruments is about the same, and requires great care to elicit. It is, of course, only in astrophysical work that the highest degree of sensitiveness is called for. Interest is lent to the subject of comparative sensitiveness of radiomicrometers from the fact that in wireless telegraphy it is radiation that is received at the distant station. It is believed that radiation differs only from the ordinary thermal radiation in respect to wave length, the wave of long-distance wireless telegraphy radiation being usually measured in hectometers or kilometers, while the wave of thermal radiation is measured in microns. Thermal radiation also varies its electromagnetic axes with respect to the direction of propagation, and is rhythmically sustained, whereas wireless telegraphy radiation keeps the magnetic axis parallel to the horizon and the electric axis vertical thereto, besides usually employing heavily damped, or rapidly decaying, wave-trains. But if we plane-polarise the thermal radiation, as is not difficult, and if we maintain sustained oscillations at the transmitting mast, which is now possible, these differences disappear. The length of the waves in wireless radiation give great advantage to the responsive apparatus, and the electric receivers, taken together with the receiving antennas, are already much more sensitive to incident radiation intensity than are the radiomicrometers of thermal energy measurements. This greater sensibility is not due to the instruments themselves, but to the fact that the great wave length makes large receiving conductors and conducting areas possible, which accumulate their effects and discharge the accumulated incident energy into the receiving instrument.

The Stockholder's Opportunity.

We have already commented more than once on the brilliant and energetic manner in which the Westinghouse interests have been righted since the October storm of financial panic, and restored to the hands of the stockholders. Such results warrant thoroughgoing optimism and belief that the process will now be carried along until the whole situation has been cleaned up, and proofs given of the entire restoration of confidence as to the future of the great industries that have taken the name of Westinghouse and the prestige of American industrial skill around the world. Note is made elsewhere in this issue of the appeal to the stockholders of the Westinghouse Electric & Manufacturing Company to support the proposed financial policy by which it is to be completely rehabilitated and provided with funds for its business, while avoiding the risks and losses of reorganization. The public has heard a good deal the last year or two about the moral responsibilities of corporations, but this higher sense of what is involved in financial relationships is broadening out to include the stockholder himself, whose duties surely are not ended when he becomes partner in an enterprise by merely putting some money into it. If it were his own business, he would prepare for and shoulder losses as well as gains, and would not expect vicariously to gather in nothing but profits. Recently in these stringent times we have seen great heads of corporations staggering under burdens of responsibility they did not assume voluntarily, and the staffs and executives submitting to ruthless cuts in salary while working harder than ever with gallant esprit de corps to "keep the property together" for the stockholders. There is an admonition for the stockholder in this, and we trust most sincerely that the stockholders in the Westinghouse Electric—possibly some five thousand—will give evidence of their solidarity in this case. It is up to them to show how well worth while it is to keep a great profitable industrial institution intact, with its compacted organism and its traditions and good will. If they fail, the shock will be felt all along the line of electrical development. If they support the plan for which Mr. George Westinghouse, with justifiable personal pride ringing in every line, makes so strong an appeal, they will never, in our humble opinion, have any cause or reason to regret it.

The Belin System of Telephotography.

A new method of reproducing pictures at a distance by electric currents over a connecting telegraph wire has recently been discussed in telegraphic and photographic circles. The method has been devised by M. Edouard Belin, of Nancy, France. It depends upon the fact that a photographic film of bichromate gelatin loses its power of swelling in water after it has been exposed to actinic light. Such a photographic film, after being exposed, developed and fixed, presents a rugged surface or variable contour, the ridges or salient points, which have swollen most, corresponding to the darkest portions of the picture, and the valleys or deepest points being those which have received the brightest lights. The photographic print is mounted on a revolving drum at the sending station, and a stylus rides on its surface like the pin of a phonograph. The up and down movement of the stylus as it rides across the ridges and valleys, corresponding to the light and dark streaks of the picture, are mechanically magnified and serve to operate a small but effective rheostat so as to modify the current in the line circuit. At the receiving end of the line is a synchronously driven cylinder. A small but strong beam of light falls on this revolving drum and produces a controlled photographic action on the sensitized drum surface. The variations in line current produce corresponding variations in luminous intensity in a rather ingenious manner. Each of the two cylinders makes about 18 revolutions per minute, and the pitch of the helical thread is 1/6th of a millimeter. Consequently a strip 3 mm wide will be reproduced in each minute. A picture 9 x 12 cms is said to occupy about 30 minutes in transmission.

Up to the present time the apparatus is only described as having been tried either on short lines or on artificial lines. Nevertheless, it is to be hoped that the apparatus will be developed so as to be capable of operation on actual lines of ordi-

nary length, if only to show what can be accomplished in the art of accurate telephotographic reproduction. It is of course no novelty at this date to reproduce pictures in some manner over a telegraph line. There have been, in fact, a number of such telepictorial methods suggested and tried at different times during the last 60 years, the efforts of one inventor after another having come to fruition and to record apparently without attaining commercial application. Two distinct types of operation have been employed, namely, electromagnetic and electrochemical. In both methods the receiving pen has operated in synchronism with the transmitting pen. Selenium transmitters and contact-makers, mechanical, chemical and electrochemical, have all been tried at the sending station. So far as we are aware, however, the up-and-down motion of a stylus upon photographically indented paper has not been brought out before. The reason that none of the preceding methods of facsimile teleprinting has come into use is that there has not been sufficient demand for the operation of telereproduction of pictures to make the effort worth while. Any such method naturally involves skilled manipulation, and in the past there has been no demand for the commodity sufficient to overcome its cost in expert service and in telegraph line toll. There are many other possibilities in this category. For example, it has been demonstrated many times that it is quite practicable to communicate with moving railroad trains by means of electromagnetic induction from neighboring telegraph wires suspended in the ordinary way, near to and along the railroad line, but the method seems never to have come into commercial use, because it does not pay to employ a special operator on board a train when a telegram can always be forwarded from the next stopping place.

On Catalogue Engineering.

This is a plea for progress in the face of certain tendencies that are becoming rather obvious in electrical and mechanical engineering. Progress is made not by drowsy acquiescence in the order of accepted "standards," but by keen initiative in improvements that later may develop or rather crystallize into new "standards." If one with an archeological turn of mind digs down into the electrical field he finds successive strata of abandoned standards overlayed one upon another like the deserted cities of Asia Minor. In its earlier history each of those cities represented active, vital growth and achievement; in its later, stagnation, decadence and oblivion. The bane of engineering at the present moment is a certain slavish conservatism that asks concerning every new plan or device not "Is it good?" but "Has it been long in use?" or has some distinguished engineering firm taken it up as standard practice? The present tendency in this country, despite much enterprise in construction, is toward an easy-going acceptance of what some other fellow has done, irrespective of whether it is the best thing for the purpose in hand or not. Considering the number of really able and well-trained engineers in our country, such a situation is both curious and deplorable.

It has been produced by the combination of various influences, many of them good in themselves but evil in combination. There is, along large lines, very little competition in this country, and, therefore, a very strong tendency to adhere to canonical methods of practice and take the resulting profits. And as might be expected, only part of the product is wholly satisfactory. American manufacturers have always been able and willing to turn out in certain lines the best product in the world. To-day American apparatus of particular kinds is sought all over the world and recognized as the very best obtainable. Yet in other things, American practice is stumbling along at the wrong end of the procession. It is the failure to appreciate this situation that leads to bad engineering. An elaborately built and thoroughly operated plant is not necessarily an example of good engineering. On the contrary, if the results cost half as much again as they ought, the engineering has been most emphatically bad, and it becomes time for the man who pays the bills to wake up and take notice. The "catalogue engineer" finds it very easy and impressive to lay out a plant from the blue-prints of one located elsewhere and to fill it up with all the necessary and unnecessary apparatus that he finds recommended in the catalogues. The ensemble, so to speak, is dignified and impressive, and the catalogue engineer finds plenty of people ready to pat him on the back and commend him for his sound and conservative methods. It never dawns upon him that he has been remiss in his duty to his clients if he has led them into heavy, needless expenditures and has given them a plant unsuitable for their purposes, however good in itself.

To give the catalogue engineer his due, he is often tempted into his bad habits by the implied attitude of his clients. It is a fact that many a plant has gone into useless and foolish extravangance for the purpose of impressing the bondholders. Some so-called engineers are chiefly promoters and look to promotion for their real profits; and some promoters want the funds put where they will make a brave showing. For these cases, catalogue engineering fills the bill most admirably. Our outcry against it is due to its pernicious influence on the art, by the suppression of all independent improvements. Now, some of the best talent in the country is engaged in manufacturing; and, first and last, improvements are many, but they are too often suspended for purely commercial reasons. Many examples of this will occur to anyone who is familiar with the progress of events, and there will be many more in the future. There is evidence too of an active element bent on steering popular enthusiasm away from radical changes into the safer and more profitable lines of canonical practice. If any evidence were required, we need only point to the code of ethics suggested for the American Institute of Electrical Engineers with its attempt to check individual initiative in favor of so-called standard practice, and to certain resolutions at the Washington National Electric Light Association convention, which we criticized at the time.

Fortunately, American initiative cannot be easily held in check, and there are always many who push forward and get results. To them we need not speak, but rather to those who fall only too easily under the spell of circumstances and wait for somebody in due season to promulgate new standards. It is for them a game of bowls and a deep potation with Hendrick and his crew in the sleepy hollow of the hills; and then the first they know they will wake out of their over-long naps to find themselves years behind the times. It is to the potential Rip Van Winkles that we would pass up the advice to quit their easy-going ways and get down to the hard work that is needed to keep one at the front in these "strenuous" days.

Annual Meeting of the A. I. E. E.

The annual meeting of the American Institute of Electrical Engineers, at which reports of all officers and of the standing committees will be presented, and the vote for officers for the ensuing year will be announced, will be held in the Engineering Societies Building, New York, on May 19, 1908. In addition to the above reports, two papers relating to lightning will be presented. Mr. J. F. Vaughan will read a paper entitled "Comparative Tests of Lightning Protection Devices on the Taylor Falls System." A paper by Mr. N. J. Neall will describe "Studies in Lightning Performance, Season of 1907."

The annual convention of the institute will be held at Atlantic City from June 29 to July 2.

Exhibits at Marseilles Exposition.

The General Electric Company is well represented at the Marseilles International Exposition of Electricity just opened. It has made through the Compagnie Française Thomson-Houston, of Paris, a fine display of railroad equipment and high transmission apparatus. The transmission of electricity for great distances across the country, the electrification of steam railroads and the development of new and better trolley roads are of great interest in the French engineering world to-day. The General Electric Company exhibit is largely historical. The development of the trolley equipment from the time of its inception, 25 years ago, to the latest single-phase equipment is shown. The very latest developments in high tension transmission is also on exhibition.

Besides these important features the company exhibits such devices as the new mercury arc rectifiers, rheostats, motors, lightning arresters and a large number of photographs of the Schenectady, Lynn and Pittsfield plants showing interior views of the great shops.

The Brooklyn Edison Company and the Tungsten Lamp.

The Edison Illuminating Company, of Brooklyn, has decided on the policy it will pursue with reference to the tungsten lamp and has issued a circular calling the attention of its patrons to the lamp and the benefits to be derived from its use.

The company states that on account of the new methods of manufacture of these lamps and the limited quantity in which they can be produced at present, the prices are necessarily high and that it is manifestly impossible for it to furnish them upon the same basis as the carbon lamps. The policy of the company, however, is to furnish such special lamps at cost, after an allowance covering the present cost of the carbon lamps furnished without charge to free renewal customers. In this way the customer will secure all the benefit of the economy of the new lamps.

The 50-watt, 25-cp tantalum lamp has been furnished to free-renewal customers of this company at an extra charge of 35 cents each. This lamp, as also the 40-watt tantalum lamp, will be supplied hereafter to free-renewal customers at 25 cents, subject to the return of the burned-out lamps. The following special prices have also been fixed for the several types of tungsten lamps to free-renewal customers, all subject to the return of the burned-out lamps: 40-watt, 32-cp, $1; 60-watt, 48-cp, $1.25, and 100-watt 80-cp, $1.50.

To customers who are not entitled to free-carbon renewals the tantalum and tungsten lamps are supplied at 15 and 25 cents, respectively, in excess of the above prices.

In order that as much publicity as possible might be given to the announcement the Edison company entertained the electrical contractors of Brooklyn at its club rooms, where representatives explained the situation to the contractors and demonstrated to them the immense possibilities of the tungsten lamp for securing business hitherto unattainable, especially in the gas field. The company's relations with the electrical contractors are very harmonious, and it is expected that with the information concerning the lamp given to the contractors an energetic campaign against the so-called gas-arc lamp will be waged. The Edison company is endeavoring to secure as large a supply of the new lamps as possible, and will fill the orders of its patrons as received, subject to its ability to obtain the lamps from the manufacturers.

Progress in Elevator Practice.

The 276th meeting of the New York Electrical Society was held in the United Engineering Societies Building, at 29 West Thirty-ninth Street, on Wednesday evening, April 29. Mr. W. N. Dickinson, Jr., manager foreign department, Otis Elevator Company, lectured on "Modern Progress in Elevator Practice."

The lecture was arranged with a view to illustrating the pronounced tendency toward the operation of elevators from electric circuits, the degree of perfection which has been attained in direct-current elevators, and the outlook for the duplication on alternating-current circuits of all classes of service now possible on direct-current circuits. With an introduction read from manuscript, something over 120 photographs were shown on the screen; the dissertation during the showing of the photographs being extemporaneous. It was evident that the lecture had been logically arranged to bring out the points as outlined, but apparently his abundance of matter caused him to give a large part of the evening before reaching the alternating-current section, in which branch of the subject the main part of the audience was manifestly interested. The society is endeavoring to have this excellent address prepared in such form that it may be published. It is to be hoped that this will be done.

After establishing the fact that any elevator service yet demanded is now possible with direct-current machines, it was shown that similar service, except that required for high office buildings in the direct-current section of the large cities, could be accomplished with polyphase alternating-current machines, simple and neat in appearance and presumably satisfactory in operation. Two hundred and fifty feet per minute, with a load of 2500 lb., was the highest speed installation mentioned, but it was indicated that higher speeds could even now be taken care of by complicating the control, and there is, of course, no limit with respect to load at low speeds. In single-phase operation it would seem that machines now installed have been confined to the smaller sizes, but the photographs of single-phase controllers showed quite as simple apparatus as for polyphase control.

Data of the Trolley in Germany.

The latest statistics available for the trolley in Germany are those of 1907. The German Ministry of Public Works has recently issued street railway statistics covering the Empire for that year ending March 31. The number of undertakings was 235, an increase of 10, while the length of all the lines was 3745.6 kilometers (2332.3 miles), an increase of 213.8 kilometers (132.5 miles), or 6.05 per cent. The total number of cars in Prussia was 11,918, equivalent to seating and standing room for 390,630 passengers; the corresponding figures for the rest of Germany were 5152 and 160,427.

In Prussia 32.5 per cent of the lines are of 1.435 meters (4 ft. 8½ in.) gage, 61.1 per cent of meter (3 ft. 3 in.) gage and the remainder are of less gage; in the rest of Germany the corresponding percentages are 10.3 per cent, 64.7 per cent and 25 per cent. Of the street railways which have not yet been electrified 17 are operated wholly or in part by steam locomotives, 27 by horses and eight by cable. Most of these lines are only one to two miles long, but there is one line in Magdeburg 14.15 kilometers (8.7 miles), which also is unique in using oxen as well as horses for motive power. Seventy-two rail-

ways handle both freight and passengers, 149 are for passengers exclusively and four only for freight.

There were 47,667 permanent employees, equal to 13 per kilometer (eight per mile), in Prussia and 13.9 kilometer (8.6 per mile) in the rest of the Empire.

Carnival at Manila, P. I.

Every year a grand carnival is held in the city of Manila, Philippine Islands, which lasts several days. During the carnival practically all business ceases and everyone devotes himself to entertaining and to being entertained. A monster parade is held, in which are many floats. The accompanying illustration

FLOAT "ELECTRA, QUEEN OF LIGHT."

shows the float of the Manila Electric Railroad & Light Company. This was called "Electra, Queen of Light." The float shows the world among the clouds with the sun in the background and lightning flashes proceeding out of the clouds. Seated on top of the world is "Electra," while among the clouds are other symbolic figures. The design displays much ingenuity and was the feature of the parade.

Electric Projects in Italy.

A bill recently introduced into the Italian Parliament provides for an extensive plan of new railway construction. The most important of the proposed lines are those from Rome to Naples, from Bologna to Florence and from Genoa to Milan. It is stated that these lines are intended for fast-passenger traffic and that electric energy, in all probability, will be used in the operation of all of them. They will be double lines and will follow the shortest routes. The entire length of the lines to be built will be about 1000 miles and the capital involved will be more than $100,000,000. The bill also provides for better facilities for tramway and motor car lines, in the shape of increased subsidies to private enterprises. Despatches from Rome state that the measure will be passed by a great majority. Another government project deals with drainage works and improvements in the Pontine marshes, which will cost about $2,000,000. When the drainage works have been completed, it is expected the soil will be found to be most fertile, and that a certain amount of hydro-electric power will be available.

Knudsen Wireless Inventions in Europe.

According to a special cable dispatch from London, of April 28, some very sensational "stunts" with the wireless are being attempted by Mr. Knudsen. The exact utility is not quite apparent, but the story is nevertheless interesting. The message says: "That he has already perfected an invention by which he can set type in an ordinary linotype machine in Paris by wireless waves thrown from London was the surprising statement made at the Hotel Cecil to-night by Hans Knudsen, the Danish inventor, famous for his achievements with liquid air, after giving the first public demonstration of long-distance wireless photography. "I shall publicly demonstrate my new wireless typesetting invention within a few weeks," said Mr. Knudsen. "I have already had the first machine constructed, and it has proved successful, setting 3000 words an hour, at a distance, just as if the operator were working the machine. The time is not far distant when, with my invention, the London correspondents of the New York newspapers will be able to send their news straight to the printing press through the Marconi operator."

In the course of his demonstration of wireless photography Mr. Knudsen to-night sent photographs of the king, queen and kaiser from one room in the hotel through the wall into another without wires, the pictures proving recognizable. He had constructed in the first room a transmitter with a needle point passing over a picture prepared on a glass plate from a photograph. The needle continually vibrated over the plate, according to the roughness or smoothness of the surface. A succession of electric waves was accurately recorded by a plate on the wall. These waves were in turn caught by another receiving plate in the adjoining room after passing through the wall, the picture being again accurately recorded by the receiving instrument on a smoked glass plate. From this plate recognizable photographs were printed on sensitized paper.

"I claim I can send pictures wherever Marconi can send messages," said Mr. Knudsen. "Within a short time I shall be sending pictures of criminals and finger prints from England to New York."

Annual Report of the General Electric.

The annual report of the General Electric Company has just been issued, and is on the whole a most satisfactory document from whatever point of view it is regarded. The sales billed for the year ending Jan. 31 were $70,977,168 as compared with $60,071,883 in 1906; and the orders were $59,301,040 as compared with $60,483,659, the slight falling off in orders being due, of course, to the financial panic of last October. During the past 10 years, the sales billed have increased annually about 19.8 per cent, and in 1907 were 18.2 per cent over the previous year. While the orders in the last six months fell off 23 per cent, they had gained 22 per cent during the first six months, which gives a crisp idea of the sharp industrial change. The report of President Coffin shows that the gross profits for the year were $6,586,653, after writing off $3,745,989 for factory depreciation, etc. Dividends were paid to the amount of $5,183,614, and $1,403,039 was carried to surplus account, making a total surplus at the end of the fiscal year of $16,513,836. The total receipts for the year were $72,484,988. Mr. Coffin says: "Late in the year there was a sudden and severe shrinkage in the value of all merchandise and materials used by your company, notably copper. All said materials, whether raw, manufactured, or in process of manufacture, which were on hand Jan. 31, 1908, were inventoried at the lower prices then prevailing. The book value of such inventories was thereby reduced by about $2,000,000. In valuing the notes and accounts receivable, in amount the largest in your company's history, great care has been exercised and liberal reserves have been established to provide for possible losses thereon. These reserves, and allowances for depreciation of factory plants, and the shrinkage in inventory values have greatly reduced the profits of your company. As a result the amount in excess of

dividends upon the share capital, which is carried forward to surplus account is relatively small."

The various securities owned by the company after a careful revaluation are carried at $18,000,089, but this does not include $2,701,975 in copper properties. The factories are carried at a valuation of $12,900,000, or only $2 per square foot of floor space, inclusive of land and equipment. Patents are carried at $1. Cash in hand was $12,250,720 and there was $20,857,726 in notes and accounts receivable. Merchandise inventories and work in hand total up $22,273,349. On the other hand accounts payable were only $1,759,517. The capital stock issued is $65,167,400, and there are not quite $15,000,000 of gold debentures out. Interesting reports are given in detail as to features of the work by Mr. E. W. Rice, Jr., vice-president, and Mr. H. W. Darling, treasurer.

Albany Meeting of the American Electrochemical Society.

The thirteenth general meeting of the American Electrochemical Society was held in Albany, Schenectady and Troy on April 30 and May 1 and 2. The general headquarters were at the Hotel Ten Eyck in Albany, where the three sessions on the morning, afternoon and evening of Thursday, April 30, were held. The session of Friday morning was held at Union University, Schenectady, and after a lunch tendered by the General Electric Company, the whole afternoon was devoted to an inspection of its works. An informal dinner in the evening united the whole party at the Ten Eyck. The session of Saturday morning was held at the Rensselaer Polytechnic Institute in Troy, and after lunch at the Rensselaer Inn various visits were paid by different parties to points of interest in and near Troy, the chief attractions being the Watervliet Arsenal, the Duncan paper mill of the West Virginia Pulp & Paper Company at Mechanicville (where the Hargreaves-Bird electrolytic chlorine plant for the preparation of bleaching liquor was shown in actual operation), the Earl & Wilson linen factories, the Burden Iron Works, and Gurley's factory for making scientific instruments.

With respect to the interest and value of the papers presented the meeting was as successful as any previous one held by the society, while the social functions and excursions were very enjoyable. The number of members and guests registered was 151.

At the business meeting the result of the election of officers was announced. Mr. E. G. Acheson, of Niagara Falls, is the new president. Messrs. C. A. Doremus, C. P. Townsend and W. R. Whitney were elected vice-presidents; Messrs. F. A. J. Fitzgerald, A. von Isakovics and S. A. Tucker, managers; Mr. T. G. Salom, treasurer, and Dr. J. W. Richards, secretary. The number of members is now 715.

The Pacific Coast Borax Company offers a prize of $500 for a process of making ferroboron from borate of lime, the prize to be awarded by the board of directors of the society.

Director Stratton, of the Bureau of Standards, communicated to the society a request to appoint a committee on units and standards to co-operate with committees of the American Institute of Electrical Engineers and the American Physical Society. The object of the Bureau of Standards is to get an expression of American opinion in regard to the questions to be taken up by the next International Congress on Electrical Units. An abstract of a paper presented in this connection by Dr. Frank A. Wolff, of the bureau (as well as an abstract of another paper by Dr. Wolff on the Weston cell) will be found below. In compliance with this suggestion a committee, consisting of the following gentlemen, was appointed: Mr. Carl Hering, chairman; Dr. Theo. W. Richards, Dr. H. T. Barnes and Dr. Edward Weston.

In the following we give abstracts of some of the papers presented at the meeting:

RESISTORS OF HIGH RESISTANCE.

The first paper of the Thursday session was presented by Dr. Howard L. Bronson on the construction and accurate measurements of resistors having resistance of the order of 100,000 megohms. In the study of radioactivity and kindred subjects it is important to measure instantaneously ionization currents varying from 10^{-15} amp up to currents which can be measured with a sensitive galvanometer. Further, the apparatus should be capable of a considerable range of measurement without serious readjustment. This is possible with Rutherford's "constant deflection method," but its application requires the use of resistor of permanent high resistance of the order of 10^{11} ohms.

The author uses for this purpose an ebonite vessel filled with an ionized gas, with aluminum electrodes. About 0.1 milligram of radium bromide is the active material which produces ionization. In general it is possible so to adjust the distance between the aluminum plates that for a considerable range of potential a linear relation exists between the ionization current in the vessel and the potential difference between the plates, or in other words, that the resistance is constant. Nevertheless it is necessary to get a calibration curve for every such vessel.

The author suggests the possibility of making standard vessels of this type and preserving them as permanent high resistance standards. They would have a much higher resistance than any of the usual standards and ought to remain constant in resistance over a long period. They would be found very useful for insulation testing or any very high resistance measurements. The paper was briefly discussed by Messrs. Wolff, Hering and Bancroft.

PRESIDENT E. G. ACHESON.

ABSORPTION OF RADIOACTIVE EMANATIONS.

A paper by Dr. R. W. Boyle gave an account of an experimental investigation of the absorption of the radioactive emanations by cocoanut charcoal at temperatures varying from very low values up to about 200 deg. C. The chief object was to compare radioactive emanations in this respect with ordinary gases, the absorption of which by charcoal at low temperatures was studied by Dewar. The chief result is that in this respect, as in others, radioactive emanations behave just like ordinary gases.

TEMPERATURE-E.M.F. COEFFICIENT OF WESTON CELL.

Dr. Frank A. Wolff, of the Bureau of Standards, gave a preliminary report on some observations on the temperature coefficient of the e.m.f. of the Weston cell between 0 and 40 deg. C. Measurements were made for every five degrees, and in each case a complete cycle was carried out, passing, for instance, from 5 deg. C. down to 0 deg., maintaining the cell at this temperature for about two days and then returning to 5 deg.

The most interesting observation made was to the effect that some cells exhibited very considerable hysteresis, especially those with abnormal initial values and also cells which were normal initially, but subsequently developed irregularities.

The following new approximate formula for the change of the e.m.f. et of the Weston cell at the temperature t degrees C. in volts with varying temperature was determined:

$e_t = e_{20} - 0.00004\,(t-20) - 0.0000009\,(t-20)^2 + 0.000000009\,(t-20)^3$

It was found necessary to use a third term in this equation, while the usual formula contains only two terms. According to the above formula the e.m.f. has a maximum within the region between 0 and 5 deg. C., while this is not the case according to the usual formula. It is interesting to note that the maximum solubility of cadmium sulphate lies within the same region of temperature and that the portable cells of the Weston type are saturated at the same temperature.

The paper was discussed by Messrs Carhart, Hering and Lidbury. In reply to a question by Professor Carhart, Dr. Wolff stated that in the temperature cycle to which the cells were subjected, those which showed hysteresis showed greater deviations from the normal values in the descending branch of the temperature cycle than in the ascending branch.

Dr. Carhart expressed the opinion that hysteresis is due to the size of the cadmium sulphate and to delay of diffusion. According to Dr. Carhart, mercurous sulphate when chemically precipitated gives better results than where electrolytically prepared. On the other hand, Dr. Wolff stated that the size of the grains of the cadmium sulphate appears not to have any effect, and that the cause of hysteresis must be found in the paste limb. Further, according to Dr. Wolff, it does not matter whether the mercurous sulphate is electrolytically or chemically prepared; no real difference was found when the mercurous sulphate was made by six or seven different methods.

MERCURY CATHODES IN NITRIC ACID SOLUTION.

A paper by Mr. J. A. Wilkinson on this subject was presented briefly in abstract by Professor Bancroft. It referred to an alleged discrepancy claimed by Tafel to exist in this case between purely chemical and electrolytic action. It is shown that this discrepancy is only apparent and that complete parallelism exists between the two cases, if only the conditions, under which the two processes are carried out, are exactly the same. The rule appears to hold true generally that it is possible to get exactly the same products either by chemical or electrolytic action if the conditions of the experiment are exactly the same.

JOSEPH HENRY IN ALBANY.

Mr. Jas. F. McElroy spoke on the early work of Henry in Albany. Joseph Henry was born on Dec. 17, 1797. In 1826 he became instructor in mathematics in the Boys' Academy in Albany. On April 6, 1829, he described before the Albany Academy the construction of his new electromagnet, which was enormously superior to former designs. Formerly bare wire was used for the magnet windings. Henry employed cotton-covered wire and was thus enabled to use several layers of wire, so as to increase the magnetizing force enormously over former constructions.

Henry also clearly understood the difference between series and parallel connection of cells. This was of importance in his first installation of an electromagnetic telegraph system in the Boys' Academy. (Dr. Carhart remarked in the discussion that this was also the first case of electric energy transmission and that one essential requirement was clearly understood by Henry, namely, the advantages of a high voltage, which he obtained by series connections of the cells.)

In the spring of 1831, Henry discovered that the galvanometer which he had in series with his magnet windings showed a momentary current when the armature was suddenly removed from the electromagnet. Faraday followed with his corresponding fundamental discovery in the autumn of the same year.

Henry left Albany in 1832 to become professor at Princeton, and later director of the Smithsonian Institution.

In the discussion which followed Mr. McElroy's paper, Dr. Carhart related some incidents of the selection of the name henry for the unit of inductance at the International Electrical Congress in Chicago.

FUNDAMENTAL UNITS OF ELECTRICITY.

It was noted above that in connection with the appointment of a committee on units by the society at the request of the Bureau of Standards, a paper was presented by Dr. Frank A. Wolff, of the bureau, reviewing concisely the present situation.

An informal international conference which had been called by the German Reichsanstalt was held in October, 1905. This conference decided on three things: first, that there should be only two fundamental units; second, that the international ohm and the international ampere should be these two units; third, that the international volt should be defined by the ohm and the ampere. The conference rejected the recommendations of the Bureau of Standards and of Prof. Carhart, who advocated the adoption of the standard cell instead of the coulometer for the definition of the second fundamental unit.

Dr. Wolff pointed out, however, that this action of the conference can only be considered as preliminary, since the conference had not yet seen fit to draw up the necessary specifications.

It will be the duty of the next international congress to adopt definitely the two fundamental units and to formulate the specifications and agree upon the values to be used in the definitions.

There is universal agreement that the ohm should be one fundamental unit. The chief question is, therefore, whether the ampere or the volt should be the second fundamental unit. In deciding this question, three points are to be taken into consideration.

First, accuracy of reproduction. (*a*) As to the fundamental principle involved, the definition of the ampere is based on Faraday's law. But, while this law may be considered as absolutely true, the weight of the silver deposit may not agree exactly with the law on account of secondary reactions. On the other hand, the definition of the volt is based on an equally fundamental principle, though it has no generally accepted name; this principle states that the loss of energy of a galvanic battery equals the coulombs multiplied by $e - T\frac{de}{dT}$ where e is the e.m.f. in volts and T the absolute temperature (Gibbs-Helmholtz equation). With respect to the fundamental character of the principle on which the units ampere and volt are based, there is no preference of one unit over the other. (*b*) As to the purity of the materials to be employed in the reproduction of the units, it should be taken into consideration that the materials can be supplied by the national bureaus or laboratories. Hence, this point may be neglected. (*c*) As to the number of measurements required, the coulometer is at a great disadvantage compared with the standard cell. The cell automatically takes up its value.

Second, concreteness is the second point to be considered. There is no such thing in a silver coulometer. When a measurement has been made, there is nothing left but a silver deposit which is of no use for further measurements. The cell, on the other hand, is always ready for further measurements.

Third, ease of reproducibility is the third important factor and here the standard cell is again at a great advantage.

If the attribute of constancy of the standard cell would be established, then taking this together with its reproducibility, the volt seems even better than the ohm as to suitability for a fundamental unit.

The German law legalizes the ohm and the ampere, but on account of the fact that the Germans have used a particular value for the e.m.f. of the standard cell since 1898, the result is equivalent to legalizing that value in the first place.

While the accuracy of reproduction by different investigators has been satisfactorily established in the case of the cell, this has not been done in the case of the coulometer, for which only relative accuracy of reproducibility has been determined.

Although in the light of the present evidence, the adoption of the standard cell may be favored, yet the Bureau of Standards, in Washington, advocates a systematic international cooperation looking toward establishing the accuracy of reproduction of both the cell and the coulometer.

CORROSION OF IRON.

Prof. Charles F. Burgess' presidential address dealt in a very interesting way with "the corrosion of iron from the electrochemical standpoint." Prof. Burgess referred to the investigations of Whitney, Walker and Cushman on iron corro-

sion as an electrolytic phenomenon and discussed the corrosion of underground steel pipes by the stray return currents from tramways, as well as corrosion without any external source of current, and simply due to lack of homogeneity of the steel surface, which results in the formation of galvanic couples. The more electronegative the impurity in the iron, the greater is the latter effect.

A large part of Prof. Burgess' address dealt with the effects of strain on corrosion. After reviewing the very contradictory results obtained by former investigators, he described tests made by himself. Test bars were subjected to tension to a point just before rupture. The tension was then released and the surfaces ground down and polished. They were then subjected to corrosion, and it was found that the part which had been strained corroded to a much greater degree. This effect was very clearly shown by the lantern slides exhibited.

In the same way portions of test bars were subjected to torsion strains. The strained parts corroded eagerly, and the electrolytic nature of the corrosion manifested itself by the fact that the surface of the strained part acting as anode remained bright (though corrosion started here), while the unstrained part which acted as cathode was covered with gas bubbles, there being a sharp line of demarkation between the anode and cathode parts.

It is generally true that strained iron has a greater tendency to go into solution. For this reason boiler plates should be drilled, not punched. Mechanical strains weaken the metal and subject it to more corrosion along the lines of weakness. The corrosion moves in certain rays or lines according to the strain lines, as was clearly shown in some lantern slides. The strains produced in tempering steel also show up in corrosion.

Owing to space limitations abstracts of several papers are held over until next week.

CURRENT NEWS AND NOTES.

CANADIAN WIRELESS STATIONS.—U. S. Consul L. Edwin Dudley reports that two wireless telegraph stations have been established in the vicinity of Vancouver. One station is situated at North Vancouver just across Burrard Inlet. The other is at Point Gray, a peninsula, seven or eight miles distant. These stations promise to be of great service to the coastwise trade between Vancouver, Puget Sound ports and Alaska.

ENGINEERING AT RUTGERS.—At its recent session the Legislature of New Jersey appropriated $20,000 for furnishing and equipping the new engineering building which is being erected on the Neilson campus of Rutgers College. Robert H. C. Heck, professor of experimental engineering at Lehigh University, has accepted the chair of mechanical engineering at Rutgers, and will begin his work in the fall. It is expected that the new building will be completed in time for occupancy next year.

TRIESTE-MONFALCONE RAILWAY.—A single-phase railway is projected to extend from Trieste, Austria, to Monfalcone, a distance of 17 miles. A survey is being made for a further length of 13 miles. The trolley line will be of catenary construction on iron poles. The power station will contain three steam turbo-generators of 500 to 800 kw each. American manufacturers are invited to submit proposals for the construction of the railway or for any parts of its equipment. Dr. Gino Dompieri, civil and electrical engineer, of Trieste, will supply information in detail.

CONDITIONS IN KOREA.—A special cable dispatch from London of May 2 says: "Andrew McKinley, who arrived Tuesday with his wife after an 18-months' tour in the Philippines, China, Japan and Korea, told the New York *Times* correspondent that Americans were having a hard time in Korea. 'At Seoul,' said Mr. McKinley, 'the manager of the New York company owning the water, electric lighting and street railway concessions told me the Japanese had made things so hot for the company that it was going out of business this summer. The result will be that the Japanese will get the concessions. The Japanese are going on the principle that Korea is for the Japanese and are pushing out Americans, English and Germans with a high hand.'"

FATHER AND SON.—The brilliant versatility of the German Emperor is well known. The following cable dispatch from Berlin indicates that his eldest son is a chip of the old block: "The German Crown Prince bids fair to become even more eclectic in his occupations than his versatile father. In addition to his numerous other occupations the following are some of the subjects to which he devotes attention: Lectures by Professor Kammerer at the Charles Neuberg Technical School on elementary mechanics and hydraulic machinery; lectures by Professor Riedler on automobiles and carburetors; lectures by Professor Slaby on electro-technics and wireless telegraphy; lectures by Dr. Schlesinger on installation of factory machinery. Dr. Reichel is also giving the Prince private lessons on electrical water power and machinery, and Professor Fraz on the groundwork of building machinery."

THE TECHNICAL PUBLICITY ASSOCIATION at its annual meeting, April 30, 1908, elected the following officers to serve during the ensuing year: President, C. S. Redfield, advertising manager, Yale & Towne Manufacturing Company, N. Y.; first vice-president, Rodman Gilder, publicity manager, Crocker-Wheeler Company, Ampere, N. J.; second vice-president, C. N. Manfred, manager advertising department, H. W. Johns-Manville Company, N. Y.; secretary, H. H. Kress, publicity department, A. S. Cameron Steam Pump Works, New York; treasurer, H. M. Davis, advertising manager, Sprague Electric Company, New York; members of executive committee, F. H. Gale, Advertising Department, General Electric Company, Schenectady, N. Y., and C. W. Beaver, special representative, Yale & Towne Manufacturing Company, New York. Twenty new members have joined the association since the last annual meeting.

LOW RATES FOR LAFAYETTE, IND.—The city of LaFayette, Ind., has just closed a contract with the Merchants' Electric Light Association, for lighting the streets, alleys and public buildings for a period of 10 years. For the last 20 years the city has been paying $66 per lamp-year, for 2200 hours of lighting, with 6.6 ampere, direct-current, open arc lamps. Under the new contract, which goes into effect Sept. 1, 1908, the company will furnish and light 300 metallic flame arc lamps, 2500 hours for $37.98 per lamp-year, and extra lighting at one cent per lamp per hour. This will amount to a saving of about $100,000 to the city in 10 years. The engineering work, preparation of specifications and contracts, has been done by Mr. J. Walter Esterline, consulting engineer. After tests made at the Photometric Laboratories at Purdue University, the Westinghouse 4-amp, metallic-flame arc lamp was selected by the Board of Works.

NEW YORK FIRE ALARMS.—In the course of the investigation of the New York fire department before the commissioners of accounts, Superintendent Martin testified last week as to the extremely bad and dangerous condition of the circuits and boxes. Mr. Kempster B. Miller, of Chicago, who made an examination of the fire-alarm telegraph system at the instigation of the Board of Fire Underwriters, testified to the generally poor condition of the system, corroborating the testimony given by Superintendent Martin, and asserting that a slight accident might, at any minute, put the system out of business and seriously endanger millions of dollars' worth of property. He believed the telegraph system was the worst thing about the department at this time; that there ought to be twice as many alarm boxes as there are, and that they should all be of a modern type. He suggested a site in Central Park as the proper place for a new building to house the central station of the system.

ELECTRIC RAILWAYS IN PRUSSIA.—The railroad administration of Prussia has decided to change to a standard gage the existing railroads between Magdeburg and Leipsic and Halle and Leipsic, and to equip these routes electrically. The total distance is 100 miles.

NATURAL RESOURCES.—The convention of governors invited by President Roosevelt to consider the preservation of the natural resources of America will begin in Washington on May 13, being preceded on Tuesday evening by a dinner at the White House. On Wednesday the conference will be opened by the President in the East Room. There will be sessions also on Thursday and Friday. Among the addresses will be one by Mr Andrew Carnegie on the mineral resources of the country. Mr. J. J. Hill will also speak, and Mr. H. St. Clair Putnam will read a paper on waterpower.

N. E. L. A. SPECIAL TRAIN.—Mr. G. F. Porter, master of transportation of the National Electric Light Association, announces that a special train for Chicago will leave New York over the Pennsylvania system on Sunday morning, May 17, arriving in Chicago at 8:30 a. m. Monday. This convention special will be limited, and applications for berths should be sent in at once. The train will be lighted electrically, and will include observation and dining cars. Reservations should be made at once by addressing Mr. Porter at the association offices, 29 West Thirty-ninth Street, New York.

REMOTE CONTROL OF ELECTRIC TRUCK.—Advices from Omaha, Neb., state that Dr. Frederick H. Millener, working under the direction of Mr. W. R. McKeen, superintendent of motive power and machinery of the Union Pacific Railroad, has built an electrically-operated truck, the movements of which can be controlled from a distance. The control devices, which are selectively actuated, are not associated with the driving machinery of the truck which latter may receive energy from either an external or a self-contained source. It is stated that the principles of wireless telegraphy are applied in the circuits of the control devices.

NEW INDUSTRY AT NIAGARA.—The Niagara Pulp Board Company has begun operating its new plant in Niagara Falls. It is located on the former site of the Acker Process Company's plant, and the electrical energy is supplied by the Niagara Falls Hydraulic Power & Manufacturing Company. The product of the plant will be pulp board that is expected to supplant lumber in the manufacture of packing cases, thus assisting in the reserve of the timber supply of the country. The plant consists of four buildings having a floor space of 20,000 ft. The output will be 18 tons every 24 hours. It is understood that the pulp board will be cut in required sizes and then nailed by machines to wooden frames.

THE COUNCIL OF PROGRESS.—One of the latest features of the N. E. L. A. Convention in Chicago, May 19-20-21-22, is the Council of Progress which the Committee on the Commercial Day program are arranging for Friday morning's overflow session. At this Council of Progress several men of national repute will give short talks on commercial subjects. Elbert Hubbard, familiarly known as Fra Elbertus, the editor of the *Philistine* and the originator of the Roycroft shop, will speak. Mr. J. R. Morron, of the Diamond Glue Company, of Chicago, and Mr. George Macbeth, of the Macbeth-Evans Glass Company, have also been secured for this meeting. There will be others. All talks will be short and a very spirited and enthusiastic council is anticipated.

SNAKE RIVER POWER.—According to advices from Washington, after a conference on May 2 with Representative Jones, of the State of Washington, President Roosevelt wrote a letter to Chairman Burton, of the Rivers and Harbors Committee, advising that he would sign the bill for the construction of a dam on the Snake River provided certain amendments are made. The basis of the proposed compromise is that there shall be no charge and no limit of time upon water used for irrigation. If over 25 per cent of the water is used for power it shall be within the discretion of the Secretary of War to fix the charge to be paid the government. Discretion is also to be vested in the War Department to terminate the right to use water for power, after 50 years. This will be the President's position on all bills relating to the building of dams across navigable streams.

RAMSEY IN VIENNA.—A special cable dispatch from Europe of May 2 says: "Sir William Ramsey's recent visit to Vienna has confirmed the results obtained by the English workers and radium experimenters in the Vienna laboratory. Possessing two grammes of almost pure radium bromide and a gramme of impure material, they are able to speak with greater authority as to their results. They have found that a given weight of radium would raise the temperature of one and one-sixth times more than their weight of water from the freezing to the boiling point. Referring to the transmutation of metals, Sir William says: 'There are different orders of certainty. I am positive that radium emanation is transmuted into neon, and in respect to the change of copper to lithium and sodium I have been successful in my four experiments. If these are as they seem, the deduction is obvious; the transmutation of the elements is proved. At the moment I am attempting the degradation of silver, which is of the same family as copper.'"

TUNGSTEN CLUSTERS ON FLAT RATE.—The Commonwealth Edison Company, of Chicago, recently formulated a proposition designed to meet the needs of consumers who have formerly used gas arc lamps. The plan is to put out tungsten lamp clusters on a flat rate to be maintained and turned on and off by the company's patrolmen in the same manner as the large number of flat rate electric signs which the company now has in circuit scattered all over the city of Chicago. These clusters consist of four 60-watt, 48-cp tungsten lamps. Under a two-year contract the company will furnish, install and maintain clusters and lamps for $1.15 per week; lamps to be lighted from dusk until 10 p. m. six days of the week, and dusk until midnight one day of the week. Under another contract lamps will be lighted from dusk until midnight seven days per week for $1.50 per week. For clusters lighted from dusk until 1 a. m. seven days a week the rate is $1.75 per week. Special care has to be taken in delivering and maintaining lamps on these clusters. At present they are not delivered in the ordinary lamp wagon, but are taken in a suit case. The company's solicitors get an extra bonus for this class of work because of its long-hour character.

N. E. L. A. CONVENTION.—Most of the final arrangements have been completed for the National Electric Light Association convention, and the exhibition will open Monday evening, May 18, at 8 o'clock. Owing to the reception at 9 o'clock on that evening in the Gold Room of the Annex, adjoining the Auditorium Hotel, it has been deemed advisable to make this a private view for Class "A" and Class "B" members, closing the exhibition on that day at 9 o'clock, thus assuring a good attendance for the exhibition without interfering with the reception. Engraved invitation cards will be placed among the papers handed to each delegate upon arriving. Arrangements have been made with a contracting firm to do additional wiring for the convenience of exhibitors. The exhibition committee reports that nearly all the available exhibition space has been taken. The color scheme decided upon is a combination of a peculiar shade of dark green, and white containing a tinge of green. The lettering of the sign boards will be in gold and aluminum. Additions to the list of those who will exhibit, which was printed in these columns on April 25, are the Studebaker Brothers Manufacturing Company, the German-American Electric Company, the Condit Electric Manufacturing Company and the Gregory Electric Company.

ENGINEERING BUILDING FOR U. OF N.—The board of regents of the University of Nebraska at a recent meeting authorized the erection of an engineering building to cost about $125,000.

A CORRECTION.—In the article by Mr. G. M. Dyott in the issue dated April 25, Figs. 8 and 9 should have their order changed. Fig. 9 is a reproduction of a photograph taken several minutes after the arc had started, and Fig. 8 represents the conditions at the instant of closing the circuit.

ELECTRICAL ENERGY.—According to a consular report a Hamburg joint stock company has purchased a large tract of land along the mouth of the River Elbe at Coxhaven, where works will be erected for the purpose of generating electrical energy from the ebb and flow of the tide. It is stated that the capacity of the plant will reach 14,000 horse-power.

INTERNATIONAL PATENT WORKING.—A special cable dispatch from Berlin of April 28 says: "It is understood here that the German government has taken the preliminary steps to negotiate a patent agreement with the United States. This action is in consequence of the prospect of federal legislation requiring foreign patentees to manufacture in the United States, otherwise their patents will be forfeited. The German law provides for forfeiture in the event of a patent remaining unused for three years if a German subject makes application to have it set aside."

ENERGY TRANSMISSION MACHINERY.—From eastern Europe an American consul reports that an officer of the local government wishes to obtain from American manufacturers full information in reference to machinery for the transmission of energy. In the region a river offers possibilities for developing a great amount of power, which at present is going to waste, and the local government wishes to utilize this power in developing manufacturing plants. If this plan is practical, it should result in the sale of a large amount of American machinery. Concerns interested can obtain the name and address of the consul mentioned by writing to the Bureau of Manufactures.

CIVIL SERVICE LABORATORY ASSISTANT.—The United States Civil Service Commission announces an examination on June 3, 1908, to secure eligibles from which to make certification to fill such vacancies as may occur in the positions of laboratory assistant in the Bureau of Standards, at salaries varying from $900 to $1,200 per annum. The duties in connection with these positions are identical with those of the assistants in the physical laboratories of scientific and technical institutions. As far as practicable, appointees are assigned to work in the subjects for which they are best fitted. Applicants should at once apply to the United States Civil Service Commission, Washington, D. C., for application Form 1312. No application will be accepted unless properly executed and filed with the commission at Washington prior to May 23, 1908.

CHECKING TROLLEY ACCIDENTS.—It will hereafter be required that the New York City street-railway companies file with the Public Service Commission a complete statement of the number and kind of trucks used, the weight of the car, length, style of fender, brake, and numerous other details. The commission took formal action to this effect last week in an effort to reduce the number of accidents on street railways in Greater New York. Commissioner Maltbie, who presented the resolution, is authority for the statement that in the six months ending Feb. 1 the street railways of this city killed 299 persons and seriously injured 944. The total number of accidents due to collisions of street cars was 1196, and the number of vehicles and persons struck by cars was 7059. According to him, at this rate in an entire year about 600 persons will be killed and 2000 seriously injured. For injuries and damages the street railways last year paid out over $2,500,000.

CHICAGO MUNICIPAL LIGHTING.—Mayor Busse, of Chicago, in a recent message to the City Council of Chicago, asks that expert accountants be employed to find out what it really costs the city to supply its own electric light. To quote from his message: "The city of Chicago has been in the electric lighting business for about 20 years, yet I have been unable to acquire from the city records exact information as to the municipal lighting plant's value or the cost of the electric lighting which the city does for itself. The records simply show from year to year the cash appropriated and expended for material and labor in the maintenance and operation of the electric lighting plants. No attempt has been made apparently to ascertain the exact cost. The city should know how much its municipally owned and operated utilities are costing and how much it has invested in such undertakings." This request was referred to the finance committee.

ITALIAN HYDRAULIC CONCESSIONS.—Confirming statements made recently in these pages, a correspondent at Rome of the London *Times* states that applications for water-power concessions are being rapidly sent in to the Minister of Public Works, and that private companies and manufacturers throughout northern Italy especially are looking forward to the possibility of "white coal" as a means of reducing the cost of production of power, which may enable industries to be carried on profitably that are in direct competition with those of other countries supplied with comparatively cheap fuel. It is estimated that Italian rivers would yield between four and five million horse-power, of which scarcely 20 per cent is at present turned to account. The city of Rome has obtained a concession which will mean an addition of 25,000 horse-power, and Naples also adds 16,000 horse-power to her supply. The American consul at Milan, Mr. Dunning, recently wrote a report on the exploitation of this matter in northern Italy.

PENNSYLVANIA TROLLEYS.—It would appear that not less than $500,000,000 is represented in the capital of the electric railways of Pennsylvania according to the annual report of the State bureau of railways, which just has been completed by Chief James W. Craig. Incidentally there is shown a heavy increase in 1907 covered in the report, not only in capital, but in assets. The total capital amounts to $464,553,942, divided between $240,224,061, the capitalization and current liabilities of companies engaged in direct operation and $224,329,881 reported by companies which have leased their lines and equipment. The capital and liabilities of the former show an increase of $36,570,620. Other increases follow, all figures being comparative and taken from reports made directly to the bureau: Capital and liabilities, $56,570,620; assets, $57,348,978; income, $3,558,260; disbursements, $3,968,397; passengers carried, 87,935,058; employees, 3396; wages, $2,098,537. More than 300 miles of new track were laid than in the previous year and the increase in cars was 690.

INTERNATIONAL CONGRESS OF INVENTORS.—With regard to the recent discussion in our columns on the relation of the United States government with inventors, and the suggestion that there should be a national society of patentees, we have a letter from Mr. Ralph T. Olcott, secretary and treasurer of the International Congress of Inventors, of Rochester, N. Y. He points out that the points raised in the discussion are those within the province of the congress, with headquarters at Rochester, N. Y., established in February, 1906, incorporated under the laws of the State of New York in February, 1907, with members in several States of the Union, a branch council in Texas, and another forming in New York City. "This is the only national organization of inventors in America. Its purpose is the advancement of the interests of inventors generally, their protection in matters of legislation, improvement in Patent Office conditions, etc. This organization is for the benefit of inventors as a class." Mr. Olcott states that an earnest endeavor is made continually by this organization on behalf of the inventor.

Generating and Distributing Systems of the United Railways & Electric Company of Baltimore.

ON Sept. 1, 1906, the United Railways & Electric Company, of Baltimore, entered into a contract with Mr. L. B. Stillwell, of New York, under which he assumed responsibility for construction work and for the operation of the plants and distributing systems of the company. Certain changes that were under way at this time had been rendered necessary by reason of the growth of the company's business and on account of the great fire in 1904, which damaged the company's largest generating station at Pratt Street, and resulted in the widening of this street when the burnt district of the city was being rebuilt. In order to conduct the work of reconstruction and operation most effectively Mr. Stillwell opened an office in Baltimore and placed Horatio A. Foster in immediate charge of the work as resident engineer. Mr. C. F. Baker was appointed superintendent of the motive-power department in immediate charge of operation and of the field work of construction.

When plants already overloaded are reconstructed and extended under conditions of steadily increasing load, new units must be placed in service before old ones can be overhauled or moved to new locations, and work of this kind can never be pushed through to conclusion with the rapidity possible in the construction of a new generating station. The results which have been accomplished in 18 months, therefore, are striking evidence of the ability and energy of the force organized by Mr. Stillwell to carry out this work.

The present article will describe and illustrate in some detail the work of reconstruction and extension as thus far completed. The results attained may be summarized as follows:

(1) At Pratt Street power house reconstruction incident to the widening of the street has been accomplished.

(2) Switch galleries designed for the ultimate control from this central location of plants aggregating in rating 120,000 horse-power have been completed and switch gear installed to the extent necessary to permit operation of the new substations.

(3) A 5000-kw Westinghouse generator driven by a McIntosh & Seymour engine ordered by the company prior to the date of Mr. Stillwell's contract has been erected and placed in service.

(4) A 5500-kw Curtis turbine unit has been installed and put to work.

(5) The steam plant has been increased by the addition of eight 450-hp B. & W. boilers.

(6) A new substation has been built on Lombard Street, near Penn Street.

(7) An addition to the Harford Road substation has been constructed.

(8) A new generating station has been built for Bay Shore Park.

PRATT STREET STATION EXTENSION AND IMPROVEMENTS.

The main generating station on Pratt Street consists of two engine rooms, between which is a double-decked boiler room.

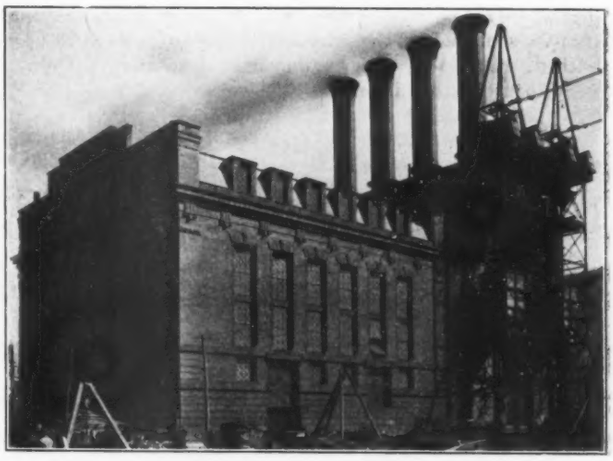


FIG. 2.—COAL-HANDLING EQUIPMENT.

For convenience in designating, the engine rooms are numbered one and two, No. 1 being that nearest Pratt Street.

The walls of the new building between the street and the boiler room had been practically completed, and a new 5000-kw engine-driven unit had been installed when Mr. Stillwell took charge. Since that time a second 5000-kw engine, which was already under order, has been erected, a 5500-kw Curtis steam-turbine unit has been installed, and the three 1800-kw direct-current machines have been moved from the position now occu-

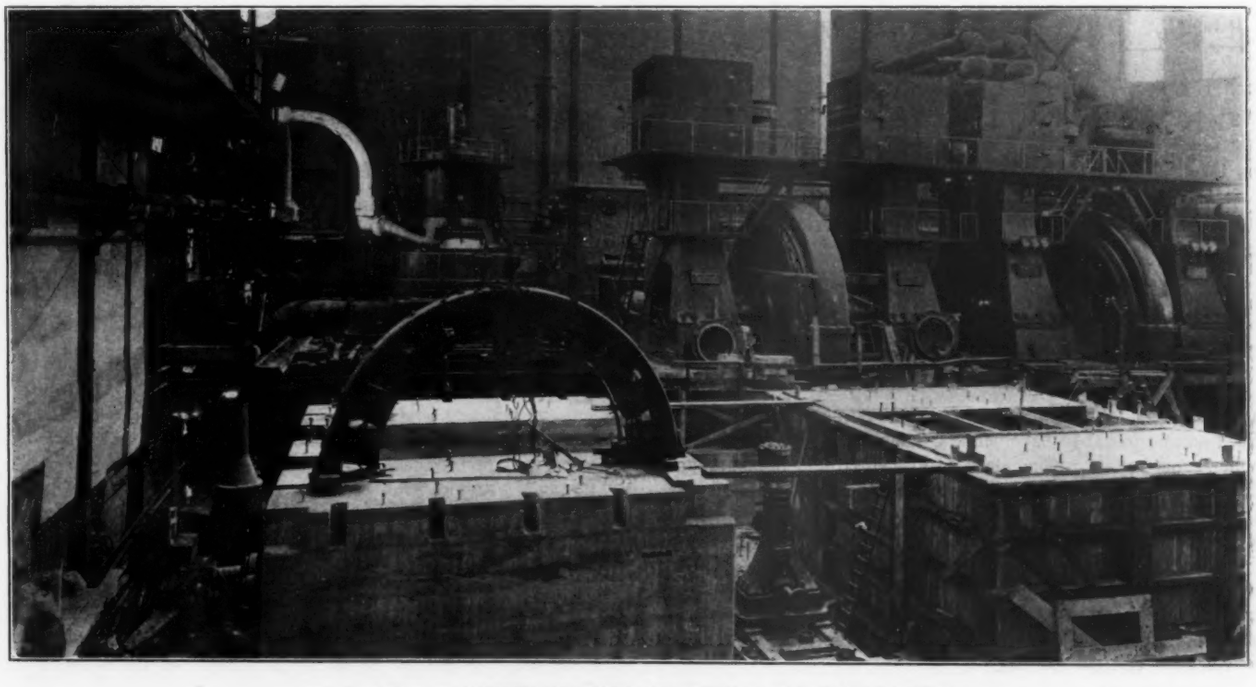


FIG. 1.—VIEW OF INTERIOR OF PRATT STREET STATION DURING ERECTION.

pied by the street into the new engine room. In addition, numerous changes in the piping and wiring have been made, a new direct-current switch gallery constructed, a new and comprehensive switching gallery, designed to control the alternating and exciting current from all sources, was planned and is nearing completion.

The total rating of the machines in the new generator room is 20,400 kilowatts, and provision has been made for the installation of an additional 5000-kw turbine. The three 5000-kw units are located in a row adjacent to the boiler-room wall. On the opposite side of a passageway and in the center of the room are two of the 1800-kw units. The third 1800-kw unit is at present in the westerly corner near the north wall of the building, but on the extension of the switchboard galleries it will be moved in line with the other two. A cross-sectional elevation of the south side of the generator station is shown in Fig. 3.

Each of the 5000-kw reciprocating units consists of a McIntosh-Seymour horizontal-vertical double-compound engine and a 13,200-volt, three-phase, 25-cycle Westinghouse generator. Each engine has twin barometric condensers located against the boiler-room wall. Independent 12-in. centrifugal pumps supply the condensing water. The pumps for one of the engines are at present driven by 500-volt direct-current motors, while the others are driven by vertical Buckeye engines.

The 1800-kw units consist of McIntosh-Seymour vertical cross-compound engines and General Electric direct-current generators. They are equipped with barometric condensers, supplied with water by centrifugal pumps in the basement driven by Buckeye vertical engines.

The turbo unit consists of a Curtis turbine and a 5500-kw, 13,200-volt, three-phase, 25-cycle generator. Fig. 1, taken during construction, shows in a marked way the difference in size of the turbine and reciprocating units. The turbine exhausts into a Worthington jet condenser placed below the floor. An independent atmospheric exhaust pipe extends from the condenser connections out through the roof of the engine room. Condenser water is furnished by a 26-in. centrifugal pump located in the basement and driven by a single Harrisburg horizontal engine. A 10-in. x 24-in. x 13-in. dry-vacuum pump is installed on the main floor for use in connection with this condenser.

The oiling system for the turbine step-bearing includes duplex oil pumps in duplicate, a receiver containing cooling coils and a Turner filter. No accumulator is at present employed. The pressure on the step-bearing is maintained at about 700 lb. The steady bearings for the vertical shaft are supplied with oil from an entirely separate system of pumps installed in duplicate, pressure being maintained at about 100 lb. at the pumps.

The Holly drip system is installed in connection with the steam piping, all drips draining to three pots located in the basement.

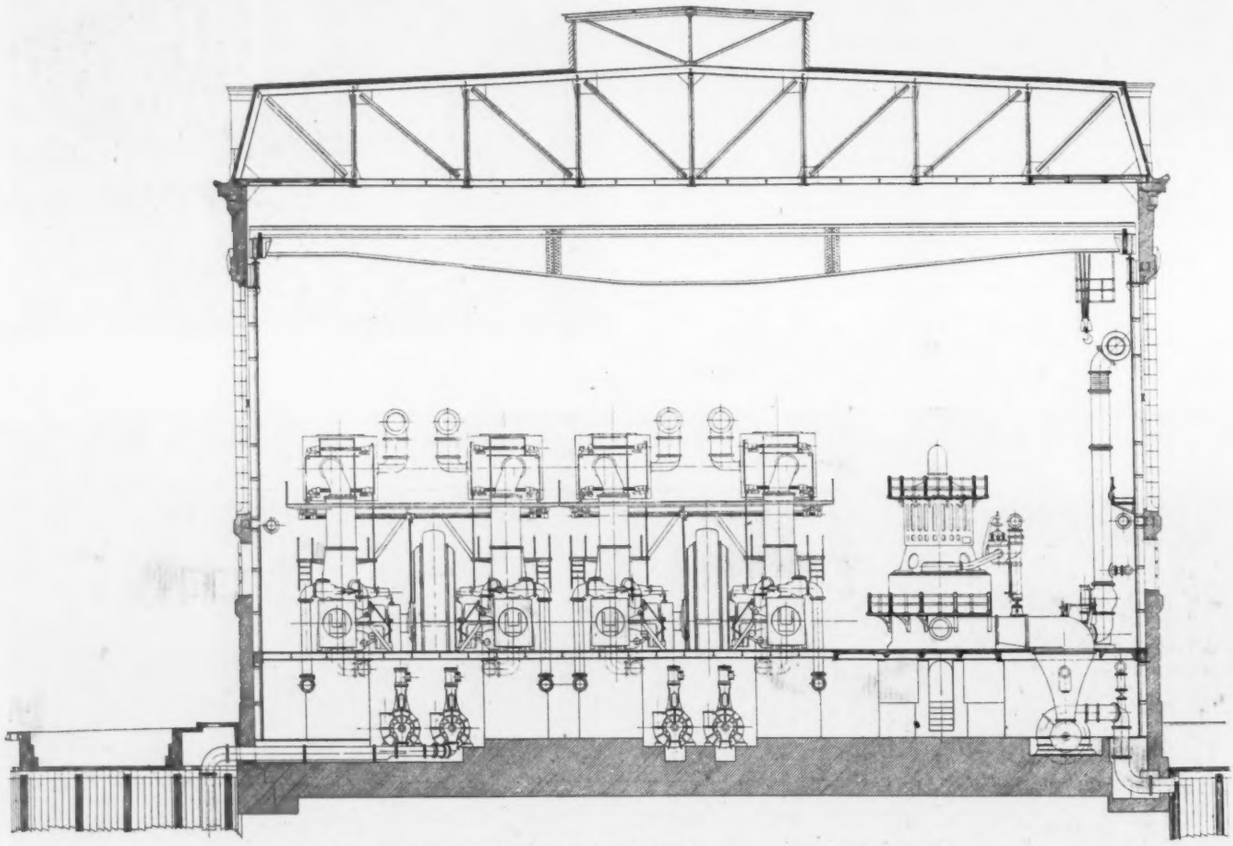


FIG. 3.—CROSS-SECTIONAL ELEVATION OF THE GENERATING STATION.

ALTERNATING-CURRENT SWITCHBOARD AND WIRING.

All alternating-current apparatus in the entire station will ultimately be controlled from a gallery built against the north wall of the building. At the present time, however, the alternators in the old engine room are controlled from the old switchboard in that room.

The plans provide for high-tension buses in both Nos. 1 and 2 engine houses, connected by heavy bus ties, in duplicate, with generators feeding energy to both buses, all controlled from the bench-board in the No. 1 engine house. When the contemplated changes are made in the buses in engine house No. 2, the high-tension system of buses and switches will be capable of handling generators having a total rating of 100,000 kilowatts, which, with certain changes in small units, could be increased to 125,000 kilowatts.

The buses, switching apparatus, controlling switchboards and wiring have all been furnished and installed by the Westinghouse Electric & Manufacturing Company.

DIRECT-CURRENT SWITCHBOARD.

The three 1800-kw, 600-volt, direct-current generators in the No. 1 engine room are controlled from a switchboard supported

on a steel and concrete gallery suspended from the east wall of the building, about 25 ft. above the engine-room floor. The generator and feeder cables from this board are carried up the face of the wall in vitrified tile ducts secured to its face.

GROUNDED NEUTRALS.

The alternators are star-connected with grounded neutral, having an oil switch and resistance in series. If a "ground" occurs in the system, it is immediately indicated on the section of the benchboard controlling the neutral apparatus.

COMPRESSED-AIR CLEANING SYSTEM.

A complete system of air piping is run throughout the switchboard structure and in the engine rooms, with outlets equipped with valves on each floor and at every generator, to which a hose-pipe may be connected for cleaning purposes. All piping is concealed. A 15-hp motor-driven air compressor and tank automatically supply this system with air at 80-lb. pressure.

LIGHTING.

The lighting is at present accomplished by using four arc lamps in series in 550-volt circuits, but the plans provide that the general illumination in the boiler and engine rooms will be done by mercury-vapor lamps on two-wire, 110-volt, direct-current circuits, normally fed from the auxiliary bus, but which may be connected to either the exciter or battery busbars.

The electrical galleries, engines, boilers, etc., will be lighted by incandescent lamps, which will be fed normally by a 13,200- to 110-volt transformer, and may be thrown on the auxiliary bus or on the exciter or battery buses.

EXCITERS.

The alternators are excited by one 150-kw motor-driven, one 200-kw and one 150-kw engine-driven generators, located in engine house No. 2. Provision has also been made for the future installation of two 500-kw engine-driven units in engine house No. 1.

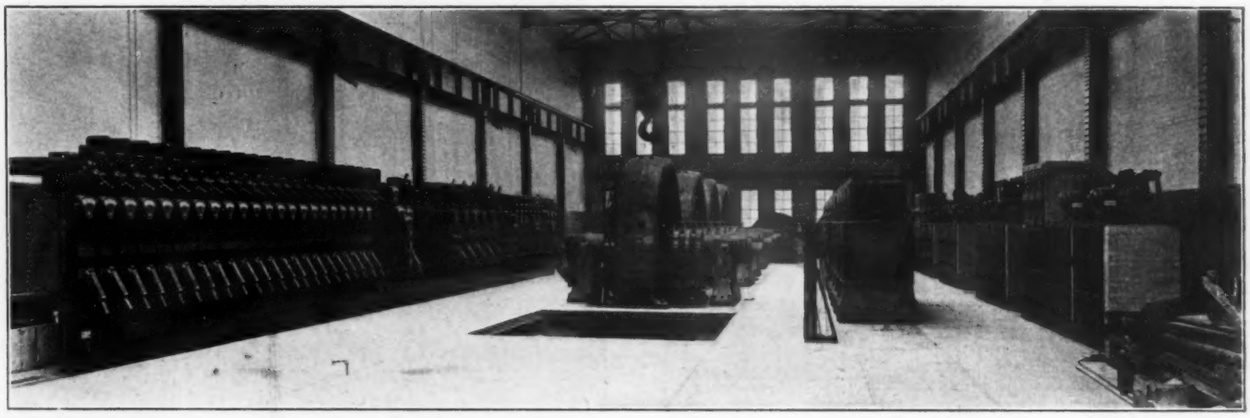


FIG. 4.—GENERAL VIEW OF INTERIOR OF CENTRAL SUBSTATION.

THE BAY SHORE TRANSFORMER HOUSE.

Bay Shore Park is lighted by energy transmitted at 3300 volts from a substation nine miles away, or from the new Bay Shore power station a half mile distant. The 75-kw, 3300/110-volt transformers used for lighting are installed in an attractive structure of reinforced concrete. Three of the transformers are connected in delta, and a fourth has been provided as a reserve. The primary and secondary leads are connected to a cable bus by means of solderless clamps in such manner that a defective transformer may be replaced with very little delay.

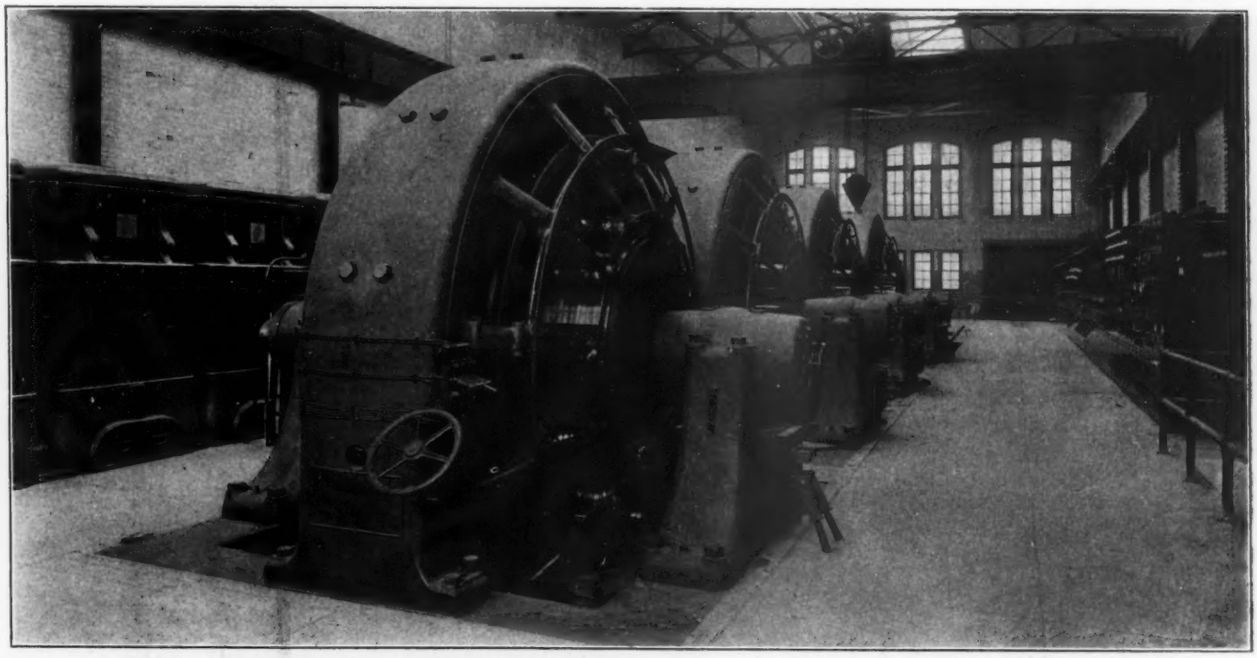


FIG. 5.—SYNCHRONOUS CONVERTERS IN CENTRAL SUBSTATION.

THE BAY SHORE GENERATING STATION.

Bay Shore Park is located about 12 miles from the main station.

The park and railway line, up to 1907, were supplied with energy from rotary converters in the Eastern Avenue substation, which is nine miles from the park. The positive necessity of providing adequate service for this place caused the adoption of some methods which under other circumstances would have been

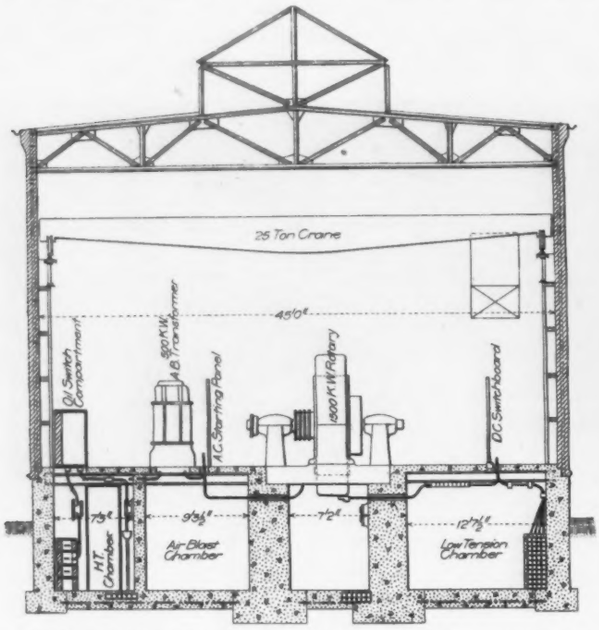


FIG. 6.—CROSS-SECTIONAL ELEVATION OF CENTRAL SUBSTATION.

given better consideration. For instance, at the price then quoted for copper, which was about 25 cents per pound, it was found to be more economical to build a new generating station near the park than to erect a high-tension line and substation, or to run the extra copper for low-tension feeders from the existing substation. As the plant was to be operated only about one-third of the year, the fixed charges per kw-hour output on a station built with new and modern apparatus would have been excessive and would have been greater than the decrease in cost due to the better economy of such a station. These conditions led to the construction of a plant made up almost entirely of machinery from several of the company's

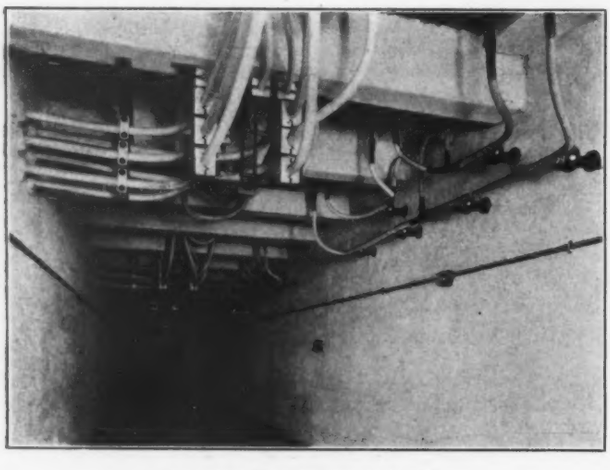


FIG. 7.—CONVERTER CONNECTION.

abandoned direct-current stations; and practically everything in the station, including boilers, engines, generators, belts and piping, was taken from such plants, the only new apparatus being an alternating-current generator for the park lighting.

The boiler equipment consists of two 600-hp and two 300-hp Morrin Climax units with independent smoke stacks. Water is obtained from driven wells and is stored in two 10,000-gal. elevated tanks. Closed feed-water heaters are located in a recess of the building at each end. Feed water is supplied to the boilers by two 7½-in. x 4½-in. x 10-in. Worthington feed pumps. Two Pohl 8-in. x 8-in. x 7-in. air lifts are used to elevate the water from the wells into the tanks.

The boilers feed steam into a ring system of mains, one line of which is in the boiler room and the other in the engine room. The pipes are supported on roller bearings and at their middle points a U-bend is provided to allow for expansion.

The dynamo equipment consists of four 200-kw, 500-volt,

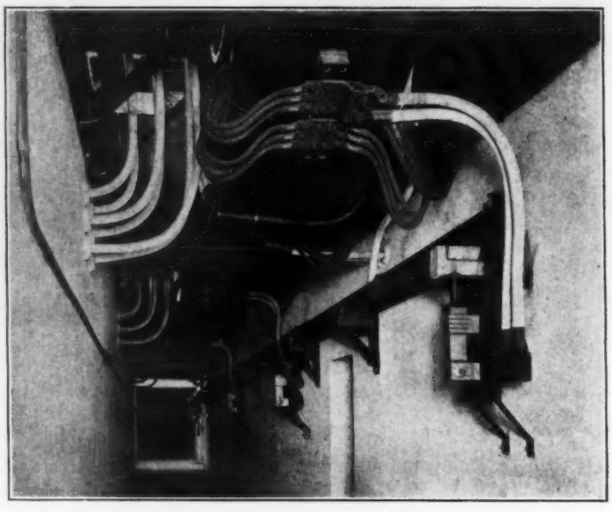


FIG. 8.—NEGATIVE BUS OF CONVERTER.

four-pole, T. H. generators, belted to McIntosh & Seymour tandem-compound, non-condensing engines; a 250-kw, three-phase, 3300-volt, self-exciting General Electric generator, belted to an Armington & Sims engine; a 375-kw, 550-volt, direct-current generator, direct-connected to a Westinghouse kodak engine, and a 200-kw, 500-volt, direct-current generator of the same type and style, for supplying energy for miscellaneous purposes at the park.

THE CENTRAL SUBSTATION.

The central substation at Lombard and Penn Streets, in a well-built-up district, is the only newly located substation erected since the reconstruction work was begun. The building, which is 154 ft. x 48 ft., is a fireproof brick and steel

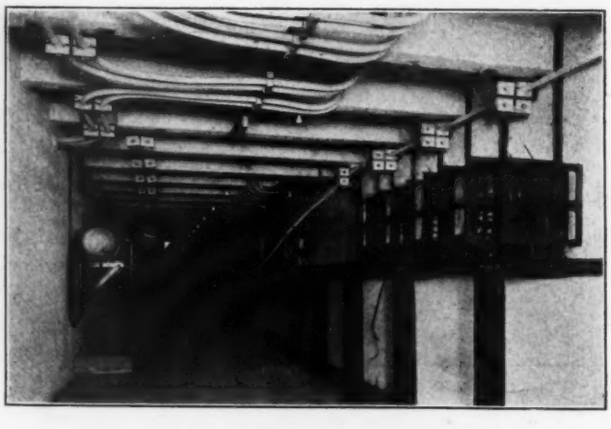


FIG. 9.—DIRECT-CURRENT COMPARTMENT IN BASEMENT.

structure and is designed for the installation of eight 1500-kw rotary converters, five of which are now in place. Figs. 4 and 5 give general views of the interior of this station. All apparatus is on the main floor level. The underground high-tension feeders enter the building through the basement near the easterly wall and are carried up to the switches placed on the floor above. They then drop to high-tension buses in the basement. Leads from these buses are carried through oil switches, and

thence on the ceiling of the basement to the transformers, all high-tension leads being kept separate by concrete barriers. The secondaries from the transformers are run across to the rotary converters, and the direct-current leads continue to the switchboard near the west wall of the building. From the direct-current swtichboard, leads drop to the basement and are carried out to the street in conduits. This arrangement, it may

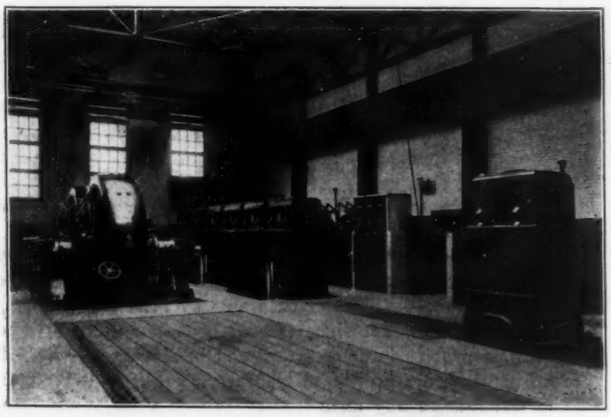


FIG. 10.—INTERIOR VIEW OF NORTHERN SUBSTATION.

be seen, confines all the high-tension apparatus to one side of the building, and all low-tension apparatus to the other side. Fig. 7 shows, on the right, the arrangement of the high-tension deltas from the bus structure, and, on the left, the low-tension six-phase connections to the six rings of the converters. Fig. 8 shows, at the left, the continuation of the low-tension wiring from the transformers to the rotary, and, on the right, the arrangement of the positive and negative from the commutator of the rotary. Fig. 9 shows the positive connections as carried through the wall to the direct-current switchboard. It also shows the field rheostats for the rotary converters.

The busbar and switch structures are built of light-colored shale brick and concrete slabs. Tests showed this brick to be well adapted for the purpose, as they withstand a comparatively high voltage test, are acid proof and do not absorb moisture. The busbar insulators are of such a design that the bars are free to move longitudinally, but are held rigid at disconnecting switches.

The transformers are of the General Electric air-cooled type and are of 550-kw capacity each. A pressure of ¾ oz. is maintained in the air-blast chamber by any two of the three motor-driven Buffalo Forge Company blowers. Each blower handles 20,000 cu. ft. of air per minute. Entrance to the chamber is provided for through an air lock at one end, equipped with air-tight refrigerator doors. Air for the blowers may be obtained from outside the building through ducts provided for the purpose, or, by opening dampers in the side of the ducts, it may be taken from the station.

The rotary converters rest on parallel concrete walls 3 ft. 6 in. thick. The base frames of the machines are cast with square corners and with vertical sides, to provide for setting the top of the frame flush with the floor, as shown in the cross-section. The rotaries are provided with electrical oscillators, and are started from the alternating-current side by means of 1/3 and 2/3 voltage taps on the transformers. The two double-throw, triple-pole starting switches for each machine are installed on panels between the transformers and rotaries. In the northwest corner of the building is a 300-kw booster for raising the e.m.f. for an outlying line, for which the regular e.m.f. of 575 volts is insufficient.

WIRING.

All wires and cables are run in conduit, vitrified tile being used in the basement for alternating-current and direct-current

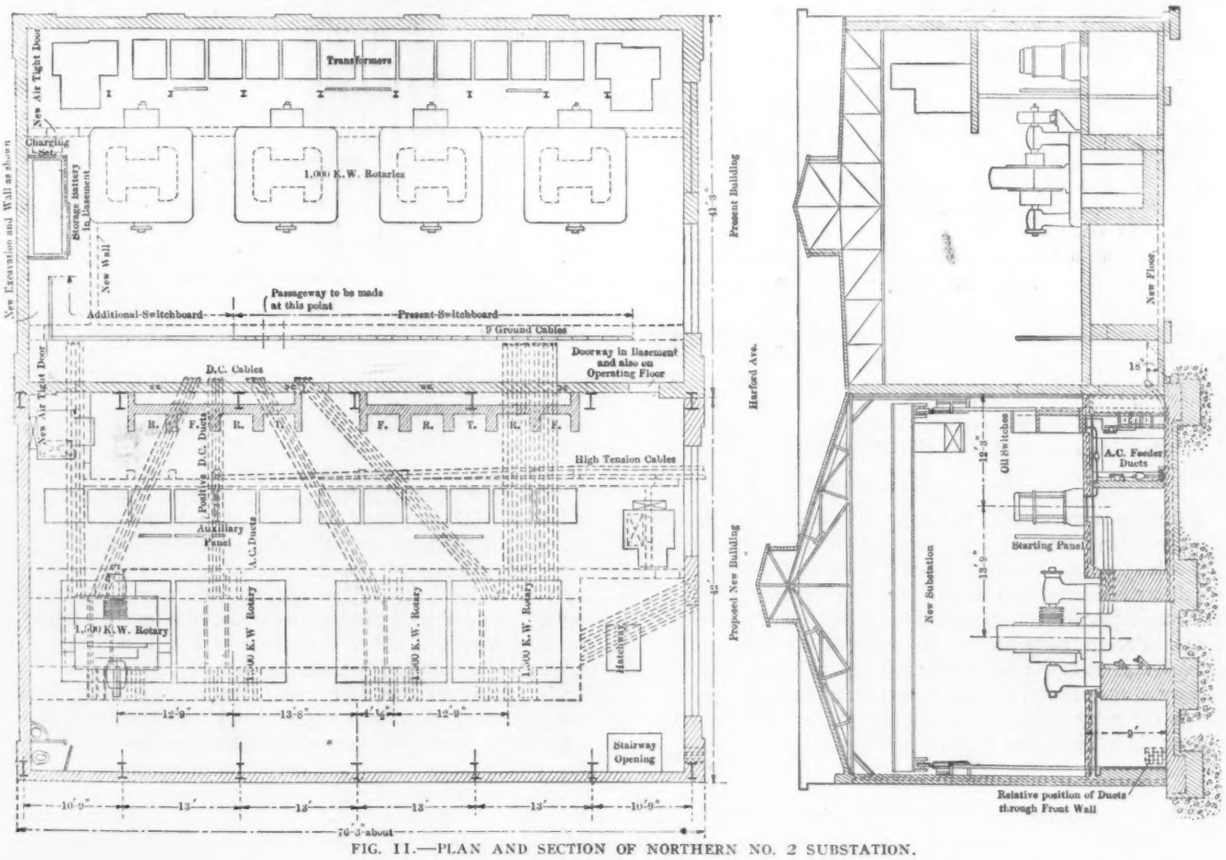


FIG. 11.—PLAN AND SECTION OF NORTHERN NO. 2 SUBSTATION.

feeders, and loricated conduits in the floor, filling and walls for control and lighting wires.

The lead-sheathed, high-tension cables entering the building terminate in end bells, from which the leads are brought out to the terminals of the disconnecting switches, which are separated by concrete barriers. The middle switch is set higher

than the two outside ones, so as to make the leads from the end bells the same length and thereby permit interchanging the connections without splicing.

THE SWITCHBOARD.

The switchboard, which was furnished by the General Electric Company, is composed of direct-current machine and feeder panels, special alternating-current control panels and special battery panels.

The special feature of these alternating-current control panels is the arrangement of the operating switches for control of the oil circuit-breakers and a miniature bus.

The station is equipped with a compressed-air cleaning system having outlets at all important points, and a complete grounding system, with outlets and flexible leads, has been installed.

THE NORTHERN SUBSTATION.

The addition to the Northern substation consists of a brick and steel building of practically the same dimensions as the original structure. The old building contains four 1000-kw rotary converters, while the new one is intended for four 1500-kw machines, two of which are now in place, as shown in the view of the interior, Fig. 10.

The new apparatus is controlled from an addition to the switchboard in the old building. In the old portion the high-tension bus and switch structures are located on a concrete gallery near the southerly wall and immediately over the transformers.

SUBSTATION LIGHTING.

Both the Central and Northern substations are lighted by Cooper Hewitt mercury-vapor lamps placed five in series on the 550-volt circuits. The incandescent lamp circuits are arranged so that the lamps may normally receive energy from 430 to 110-volt transformers, or may be thrown on the control batteries. For emergencies, two arc lamps at the Central and four tungsten lamps at the Northern substation are connected through a relay to the battery, so that when current fails on the mercury lamps the relay closes the battery circuit through the tungsten lamps; thus the station is never without light.

ENGINEERING.

In addition to personal supervision on the part of Mr. Stillwell, the mechanical portion of the work has been under the care of Mr. John Van Vleck, and the electrical under that of Mr. H. S. Putnam, Mr. Stillwell's associates in New York.

The treatment of the entire matter of an unfailing supply of energy has necessarily been rather heroic, and the efforts of the engineers have been fully and promptly supported by President William A. House, the entire board of directors, and the engineering staff of the United Railways & Electric Company.

Oxy-Hydrogen Welding.

By Frank Koester.

THE custom of welding iron, steel, copper, etc., by mechanical means is rapidly being replaced by the process known as "autogenous welding," which has been in use for a number of years abroad and is now being introduced to some extent in this country.

Autogenous welding embraces all methods of welding in which the parts to be united are joined together in a homogeneous manner, the joint being made by the intermingling contact of the fibers of the material to be welded so that the finished piece is of uniform quality and properties throughout. The process is carried out by several methods, namely, the oxy-acetylene, the purely electrical and the oxy-hydrogen method. The latter, which is most extensively used, is the subject of this article.

Before discussing the process of oxy-hydrogen welding it might be well to describe the means by which oxy-hydrogen is produced. The disintegration of water by electrical means is a very old process, but since electricity is now generated so cheaply this process is extensively used in many industries, its use no longer being limited to laboratory work.

The water is usually disintegrated in iron vessels, with iron

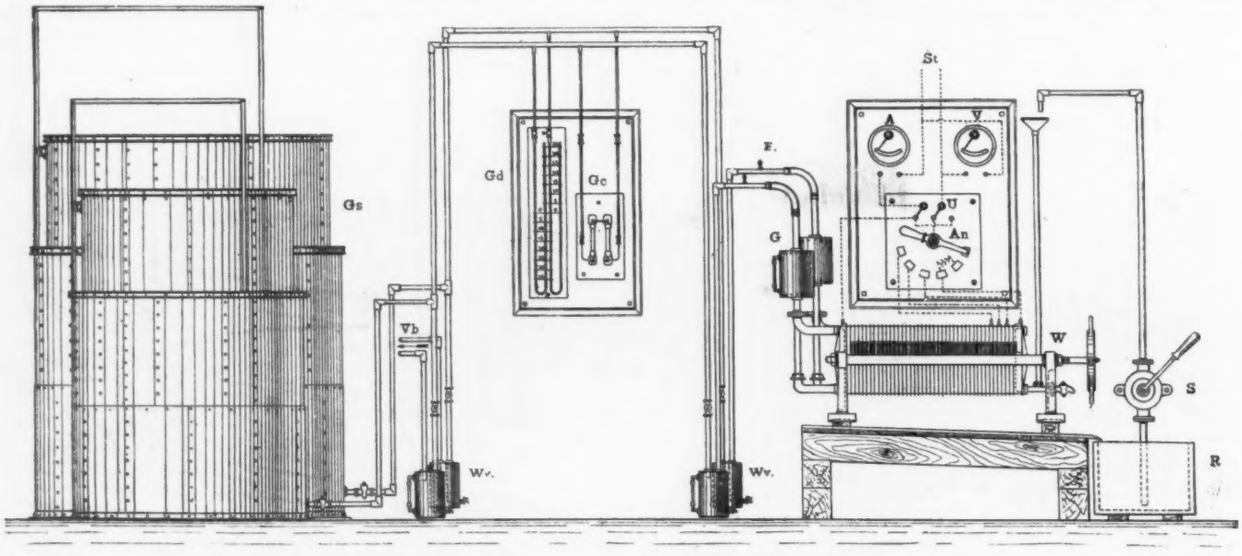


FIG. 1.—ARRANGEMENT OF AN ELECTRIC WATER-DISINTEGRATING PLANT.

electrodes and the use of alkali solutions. This apparatus, however, besides being expensive, requires an enormous space for its installation. The following described apparatus, however, is of a very compact design, of very simple construction, requires a minimum of attention, is safe in its operation and permits the production of this gas under relatively high pressures. It consists of a number of ribbed iron plates, between each of which is placed an asbestos-woven slab. Several of these, the number depending upon the size of the apparatus, are mounted upon a frame, as seen in Fig. 1, and means are provided for compressing the slabs and plates between two heads. As is the case in a storage battery, the space between two plates, or electrodes, together with the asbestos slab or diaphragm, forms one cell. The electrodes are of cast iron, the surface being ribbed and the edges being raised to form a frame, thus enabling the plates to better compress the asbestos diaphragms. Each electrode is provided with three drilled holes, one edge of the electrode being provided with two holes, one at each corner, and the opposite edge with one hole located centrally between the two corners. These electrodes are arranged so as to alternately bring the single hole to the top and the bottom of the stack of plates. The two upper channels form passages through which the gases, the hydrogen and oxygen, flow. These channels are connected to so-called gas separators in which the gases are separated from the fluid.

The latter returns to the cells of the apparatus through the lower channel.

A vigorous circulation of fluid is accomplished by the process of gas generation, which circulation is essential for the proper working of the water disintegrating element.

In the following table the theoretical data are given for various sizes of water disintegrators, showing the electrical current required, the number of cells, the amount of water supply and the amount of both hydrogen and oxygen gas produced. Direct current is used, and as this is a wet process, it is not practical to use an e.m.f. higher than 250 volts.

Current Amperes	e. m. f. Volts	Power Kilowatts	No. of Cells	Supply of fluid in cu. ft. per hour	Gas Production. per hour. Hydrogen in cu. ft.	Oxygen in cu. ft.
20	65	1.3	28	1.43	7.41	3.53
40	65	2.6	28	2.45	14.82	7.41
75	65	4.9	28	6.65	27.88	13.76
125	65	8.1	28	10.50	46.59	23.29
20	110	2.2	48	2.17	12.70	6.35
40	110	4.4	48	3.53	24.41	12.70
75	110	8.2	48	10.54	47.65	23.65
125	110	13.8	48	17.50	79.37	39.53
20	220	4.4	96	3.85	24.41	12.70
40	220	8.8	96	7.08	51.18	24.41
75	220	16.5	96	20.30	105.31	47.65
125	220	27.5	96	31.56	158.85	79.37

The e.m.f. required per cell is about 2.7 volts with the fluid at the initial temperature, while with a temperature of 140 deg. Fahr., the e.m.f. required is 2.3 volts per cell.

So long as the generation of gas has not yet begun, the resistance in the disintegrating apparatus is low. For regulating the current a rheostat and cell switch are required so that any number of cells may be connected in succession.

The fluid supplied to the apparatus is a solution consisting of distilled water containing 10 per cent of pure potash (carbonate of potash). The use of pure water, particularly free from chlorine matter, is essential for the continuous proper operation of the plant. Artesian well water or water of condensation cannot be used advantageously.

For the production of 10 cu. ft. of hydrogen and 5 cu. ft. of oxygen, with a working temperature of about 100 deg. Fahr., about two kw-hours are necessary and about six-tenths of a gallon of water will be required. With an increase of temperature more economical operation may be secured, but the temperature should not exceed 160 deg. Fahr.

The process itself gives up heat to the fluid, but in order that the process of disintegration may begin with the proper temperature the fluid may be heated by steam.

Under ordinary conditions the pressure of gas produced is 3.5 lb. per square inch. However, by using an auxiliary device, a pressure of 35 lb. per square inch may be secured.

The principal requirement is to produce both pure hydrogen and oxygen gases. With uninterrupted operation and normal voltage, and with a temperature not exceeding 100 deg. Fahr., the oxygen will contain not more than 3 per cent of hydrogen, and the hydrogen will contain not more than 1 per cent of oxygen. Should the e.m.f. drop below the normal, each gas receiver will contain a greater percentage of the other gas than given. After every interruption of the service, and upon restarting, the gases are impure and should not be discharged into the receiver, but should first be exhausted into the atmosphere.

For the purpose of controlling the purity of the gases generated, the supply pipes are tapped and the gases ignited. The character of the flame indicates the purity. The gases are conducted through two water columns, and if the mixture is an impure one the flame will kick back to the water column and extinguish itself. The report resulting will show that the gases were explosive.

In large disintegrating plants it is more desirable to have an analyzing apparatus for testing the purity of the gases.

For the purpose of securing continuous and economical operation of the disintegrating apparatus, as the demand upon the latter is not always uniform, storage tanks or gasometers for the gases generated are made use of, the one for hydrogen being, of course, of greater size than the one for oxygen, since the latter is produced and required in greater proportions.

The cost for generating these gases by this process is governed by the price of the electric energy. As previously stated, 10 cu. ft. of hydrogen gas and 5 cu. ft. of oxygen gas require two kw-hours for their production. Assuming that a kw-hour can be had at from 1 cent to 6 cents, the quantities of hydrogen and oxygen gases as above given would cost from 2 to 12 cents for their production. When the gases are not used at the pressure of production they are compressed into pressure flasks up to about 3000 lb. per square inch for shipment. The cost of charging these tanks will, of course, depend upon the facilities at hand.

Where these gases are used in great quantities for the purpose of cutting, welding and other purposes, the manufacturer may install his own disintegrating apparatus. Special plants have been established abroad for producing these gases and supplying them to the various users, the pressure flasks when exhausted being returned to the disintegrating plant.

The disintegrating apparatus described above is manufactured by the "Oerlikon Company," of Switzerland, under the Dr. O. Schmidt patent. Fig. 1 shows the arrangement of the apparatus of an electric water disintegrating plant. The current enters at S_t, being controlled by the rheostat A_n. The fluid is taken from the reservoir R by the supply pump S. W is the water-disintegrating apparatus; G is the gas separator;

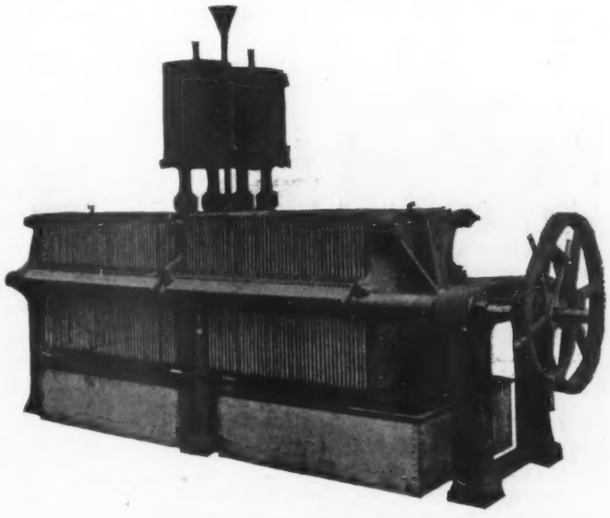


FIG. 2.—DISINTEGRATING APPARATUS.

E represents vents; W_v shows water seals; V_b indicates distributing pipes, and G_s shows gas storage tanks. Gas-testing apparatus are shown at G_e and G_d, while electrical measuring instruments are indicated at A and V. Fig. 2 shows disintegrating apparatus which, operated at 125 amperes and 220 volts, delivers 158.85 cu. ft. of hydrogen and 79.42 cu. ft. of oxygen per hour.

THE PROCESS FOR CUTTING AND WELDING.

One advantage in welding by this process consists in doing away with all riveting, such as would be necessary in the manufacture of shell boilers, drums, tanks, etc. Another advantage is that the process will serve for cutting plates, pipes, etc., as these same gases may be used for this purpose, dispensing entirely with the great variety of tools required for cutting at present. Of the many other advantages one of the most important is that with this process, where additional connections are required to boilers, tanks and piping already installed, holes may be cut and nozzles welded on in a very short time and without dismantling any part of the installation. This process is of extraordinary importance in connection with the equipment of modern power plants.

Special tools have been designed, one for cutting circular and oval holes, such as handholes and manholes, another for cutting holes in pipes, another for cutting the end of the nozzle to the proper form for joining it to the pipe, etc. The

cuts made are perfectly smooth and require no subsequent finishing.

In the manufacture of fittings by this process, such as tees, manifolds, Y's or elbows with outlets at any degree desired, much time may be saved in the filling of orders. The delivery of cast-iron fittings, either large or special fittings, is always delayed because of the time consumed in the pattern shop, foundry and machine shop.

Furthermore, the material used in these fittings is much more suitable for modern power-plant practice in which high pressures and superheat are essentials. The fittings are lighter than any cast fittings, since they are made up of standard wrought iron or steel pipe. The number of hangers, anchors, etc., as well as their weight, is reduced, as is also the labor necessary in erection. The number of flanges necessary is considerably reduced owing to the fact that all outlets may be made on a full length of pipe. The flanges themselves may also be welded to the pipe by this process, and where loose flanges are required shoulders may be welded on.

In the manufacture of boilers, drums for boilers and tanks, the longitudinal seams and other seams, as well as the heads and any outlets, may be welded in this manner. Certain types of superheaters may have heads and tubes welded together to form a single piece, doing away with the possibility of leaky joints. As a superheater of this kind is complete when delivered, it is necessary merely to connect it to the system of piping, as is done with valves, etc.

The process of cutting and welding material is an exceedingly simple one and may be done by unskilled mechanics after receiving slight instructions as to the handling of the apparatus.

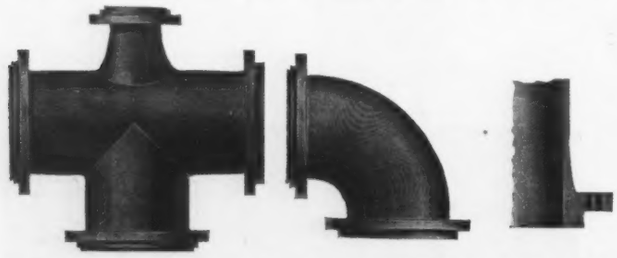


FIG. 3.—AUTOGENOUS WELDED STEEL PIPE-FITTINGS WITH LOOSE FLANGES.

As already pointed out, the hydrogen and oxygen is contained in two pressure flasks from which each is delivered to the blow pipe of the cutting or welding tool through rubber tubes, the pressure being regulated by special reducing valves. For cutting material, the gases may be used independently, one for heating and the other for cutting. The hydrogen gas flame is used for heating, it requiring only a few seconds to heat the surface to the desired degree of temperature, after which the oxygen is turned on and the cutting done. The cutting off of a 6-in. pipe being accomplished, after the tool is set, before one realizes that a start has been made. The cut will be about 3/16 in. in width. Cutting a 3-in. square bar requires about 90 seconds. Plates 0.04 in. in thickness to 12-in. armor plate may be cut, blower nozzles of different sizes being used for various thicknesses of materials. Material of 0.04 in. in thickness requires a blow-pipe outlet 1/16 in. in diameter, while that 3/8 in. in thickness requires an outlet 1/4 in. in diameter. The cut will be equal in width to the blow-pipe outlet. If the material is of good quality, the joining surfaces need no finishing whatever in welding. This is true also of such pipe surfaces as are to be united in making a welded joint as the heat generated is such as to remove all objectionable substances from the surface.

To define more clearly the operation of cutting a circular or oval hole in a plate, the following description is given: A small hole is drilled in the plate as a center and for bolting on the apparatus, which is provided with a template acting as a guide for the blow-pipe nozzle in its travel along the circumference of the hole to be cut. The hydrogen gas first flows through its nozzle, and is ignited and followed closely by the oxygen delivered through its nozzle. The nozzles are placed a few inches apart on the same apparatus, and the former (hydrogen) heats the material, while the latter (oxygen) cuts it. The whole apparatus, which is a light instrument, is revolved by hand. When cutting an oval hole an oval template is used. All that is necessary for cutting holes of different sizes is to insert a different size of template.

Another apparatus for cutting holes, in pipes, for instance, is arranged to follow the line of intersection. An apparatus for cutting off pipes is also used.

The process of welding consists in mixing hydrogen and oxygen either at the nozzle of the blow pipe or within the chamber of the blow pipe. The latter form is preferable as it procures a more thorough mixture before the gases leave the nozzle of the blow pipe. In either case the hydrogen is first turned on and ignited. Then the oxygen is turned on, the cocks being located in the inlet pipes to the mixing chamber of the blow pipe, the flow of each gas being controlled as required for a proper mixture. If for any reason, after the proper mixture is established, the supply of hydrogen should be accidentally reduced, the flame would kick back into the blow pipe, and to prevent its backing up into the supply lines and tanks, safety devices may be inserted in the supply inlets to the blow pipe. In starting up again after such kick it is necessary that the blow pipe first be allowed to cool off so that the gases will not be ignited upon entering.

The temperatures created at the nozzle of the blow pipe ranges from 1500 deg. to 5000 deg. Fahr., the thickness of the material determining the temperature to be used and which is easily controlled by cocks for regulating the supply.

The process permits of lap-welding and butt-welding, and additional material for reinforcing may be added. In lap-welding a smaller quantity of hydrogen and oxygen is used than in butt-welding. The amount of gas used for welding a 1/8-in. plate per running foot is, in the former case, from 1.7 to 3 cu. ft. of hydrogen and from 0.6 to 1 cu. ft. of oxygen, and it requires from four to six minutes to make the weld.

The welded joints are equally as good, if not superior, to the material welded. If the proper mixture of gases has been employed welded parts are as easily machined as the material itself.

This process is utilized not only for new work, but also in making repairs at the plant which otherwise might have to be shut down until a new piece or the repaired part is secured from the maker. For example, a break in a connecting rod, eccentric rod or any other may be easily welded without even dismantling it. A split in a pipe line may also be patched without disconnecting the pipes. There are many other industries in which this process may be applied with great success.

Electricity in Rio de Janeiro.

Much has been written about the remarkable transformation undergone by the Brazilian capital during the past several years, but so far little has appeared concerning the electrical development which had just preceded and has since traveled hand in hand with it. Yet judging from results already attained and from tangible prospects of much greater things to come, it is safe to say that Rio de Janeiro will present before long one of the most interesting, and possibly for Americans above all other foreigners, one of the most profitable engineering undertakings of its kind in the world.

When one who knew Rio in the olden days of yellow fever fame, stirs up memories of the vast labyrinth of narrow, crooked, unsewered, boulder-cobbled and poorly lighted streets, with its legions of mosquitos and musket-carrying policemen, and then compares the vision with Rio of to-day, it must appeal to him like the realization of one of Scheherezade's tales in "Arabian Nights." Of course, the conquest of yellow fever, which came with the elimination of the mosquito and the reconstruction of underground sewers, will always be the greatest boon that could have happened to the city; but the most

spectacular and unique and certainly one of the most far-reaching changes wrought will be the introduction of electricity on a large commercial scale.

The tallow candle, of which one of the largest factories in the world is located in Rio; the antiquated oil lamp, the gas jet and the more recent but none the less cumbersome acetylene lamp, are slowly going down before the incandescent and the arc. Induction motors are gradually replacing hand cranks in manually operated sugar refineries, tobacco shops, coffee trapiches, rice mills, etc., while more pretentious establishments are divesting themselves of steam and gas engines and are getting into the line of hydro-electric power users.

The first lighting and power plant in Rio de Janeiro, as in most other cities, was a gas concern. Years ago an Englishman acquired the concession and built an extensive system which, with modifications and additions, has ever since supplied public and private lighting and to some extent gas power. This plant is the nucleus of the American company now exploiting the lighting and transportation utilities of Rio de Janeiro. An owning and operating syndicate with engineering headquarters in New York, they control the exclusive concessions for the electric light, power and telephone service in Rio, and besides having purchased the gas company, own three of the four electric tram lines with a total of 42 miles of single track; all of the mule car lines with a total of 90 miles of single track, and one steam cog road. The mule cars are to be entirely removed and replaced with broad-gage electric trams, and work has already commenced on this project.

This company has in the course of construction a 30,000-kw hydro-electric power plant 81 kilometers (50 miles) from Rio, and it is expected that one of the new 5000-kw generators will be placed in commission about the first of March of this year. This organization is the one from which the babe of electricity in Rio de Janeiro is to receive its principal nourishment. With some of the best American engineering talent, imbued with considerable of the so-called American "hustle" (which, if it is genuine, has to be softened down a bit in Brazil or any other tropical country), and having absolute monopolies in its several commodities of from seven years, as for light, to 90 years for tram service, this company should, if the advantage is properly followed up, prove a strong wedge for American manufacturers desiring to enter the Brazilian market.

Power at present used is brought from a temporary hydro-electric plant of 1500 kilowatts at the head works and also from an old German steam plant of 1250-kw capacity, the latter being used, however, principally for street railway work. The main generating station of the Light & Power Company will be, when completed, the largest in South America, and probably one of the most carefully designed works of its kind in existence. Power is derived from the impounded flood waters of a small mountain stream having a fall of 900 ft. in less than a mile. The storage dam, which is built at the top of the rapids, has a maximum height of 151 ft. with a capacity of 224,000,000 cubic meters. This enormous storage capacity is made possible by a peculiar topographical formation of the mountains, the dam closing up a very narrow gorge at the lower end of a long valley extending a great distance up stream and having many ramifications.

The energy in this stored volume of water is extracted by means of six Escher-Wyss impact wheels of the vertical type,

FIG. 1.—THE AVENIDA CENTRAL, SHOWING NEW METHOD OF ILLUMINATION.

direct-connected to six vertical shaft generators. The wheels operate under a head of 1000 ft., each wheel having four needle valves playing 90 deg. apart. The entire plant is of American manufacture with the exception of the turbines and their governors. The energy of this falling water when converted into electricity is transmitted to the city over a double steel tower transmission line. These lines follow a carefully selected route through the mountainous and thickly wooded country which everywhere surrounds Rio de Janeiro, and form a distinctly unique piece of that kind of engineering. There are 972 galvanized steel towers used in the two lines, each of some 46 ft. in height, and each tower line carries two three-phase circuits.

The main city substation will have, ultimately, a capacity considerably in excess of the main generating station, as it will include a gas-engine auxiliary plant of 10,000 horse-power. There will also be a storage battery with sufficient capacity to carry lighting and railway peaks, and a very complete rotary-converter equipment.

The city distribution system as it leaves the substation comprises 13 6000-volt, three-phase underground feeders supplying 80 transformer vaults scattered throughout the city. These vaults, varying greatly in their different capacities, in turn supply 200- and 400-volt secondaries connected three-phase star with neutral. The neutral on all circuits, high and low tension, is grounded. All power work is straight three-phase star, but lighting is carried across the neutral and the three-phase wires at 120 volts. Each of the high-tension feeders has an automatic subway switch which is also capable of being opened or closed from a central point in the city.

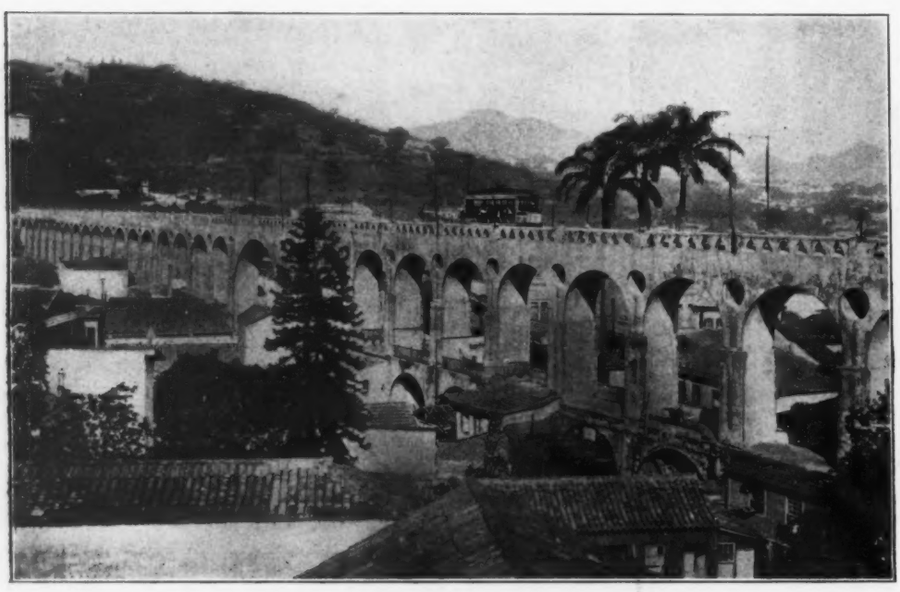


FIG. 2.—ELECTRIC RAILWAY ON 200-YEAR-OLD AQUEDUCT.

Aside from the American company there have been and still are several companies which sell direct current in small quantities. They charge about 15 cents per kw-hour from coal plants as against 24 cents per kw-hour of the American company from combined coal and hydro-electric plants.

Brazil, having practically no coal deposits of her own, is naturally dependent on other fields for her supply for railroad, steamship and manufacturing purposes, and Wales is the chief source. Welsh coal delivered in Rio de Janeiro costs about $9 per ton, and this price is materially increased before the coal has been used, the result being that, wherever possible to be obtained, hydro-electric power is by far the cheapest, and in every other respect the most desirable, for tropical work. Its supply in abundance cannot fail to work a complete revolution in the present economic as well as the engineering phase of Brazil's manufacturing and transportation facilities.

At present there are 60,000 buildings in Rio, less than 400 of which have electric light or power in any part of them; and of this number about 65 have private, direct-current coal or gas-driven plants. In a city of nearly a million inhabitants there are scarcely 15,000 incandescent equivalents in electric lighting. In the railway field there are in operation some 152 miles of single track, divided up as follows:

Jardim Botanico Company—Steam plant; Brazilian and English capital; American equipment; 120 motor cars and 100 miles of track. Villa Isabel Company—Steam plant; Canadian and European capital; American equipment; 71 motor cars and 42 miles of track. Carioca Company—Steam plant; Brazilian capital; American equipment, operating a few cars on about 10 miles of track. Tijuca Line—Steam plant; Canadian and European capital; American equipment; 5 miles of track.

There is also a very extensive system of broad and narrow gage mule car lines in the older portion of the city which must be electrified in the near future, to fulfil the American company's obligations to the municipality of Rio de Janeiro. Work has been commenced on this project and is to be pushed.

Until recently, with electricity costing the city government 24 cents per kw-hour for arc lamps, public lighting has been restricted to the more prominent streets. At present there are about 10,000 gas lamps on the streets of Rio, and it is safe to say that the next two years will see the installation of at least 2000 arc lamps for public lighting.

More than ordinarily good street lighting is necessary in Rio by reason of the vast hordes of restless and wholly irresponsible human beings composing the lower classes. It has been said that an arc lamp in a dark place in Rio de Janeiro is as good as a policeman toward making the city a safe place at night. The Avenida Central is an example of the generous manner in which the new régime is reconstructing the Federal capital. It is an entirely new street cut across the old part of the city, the central business districts, and in its lentgth of nearly a mile has 200 electric series alternating-current arc lamps and 660 gas lamps. This avenue has already cost the Government and individuals the immense sum of $36,000,000, and having been built on the most lavish scale, is naturally the center for the very best business houses. One might well expect to find there a fair representation of electric display and advertising illumination, but as a matter of fact it is conspicuous by its almost total absence.

It is only with the quite recent advent of the Parisian Cinematograph theaters, of which there are some 15, that the Brazilian merchant has had an opportunity of seeing the value of decorative or purely publicity lighting. In the past few days several large signs have been installed, breaking the ice, and considering the love of gay colors, bright light and dazzling splendor inherent in the Latin blood, Brazil should be a particularly good market for light-producing apparatus.

Heretofore most of the public buildings and churches have had their outlines marked with perforated gas pipes which at night, during festive occasions, were lighted, producing very pleasing effects; and it is quite a common occurrence to see flower beds and walks outlined with different colored glass cups containing burning wicks floating in oil.

So far electricity in Rio de Janeiro has been confined principally to the more prosperous, with less attention to economy than to the novelty of it. The really first step taken with the

main idea in view to attain greater economy in operation was indicated recently by the signing of a contract by the owners of the Carioca Cotton Mills Company for the complete electrification of its mills, involving about 1600 horse-power. The substitution of coal by electricity in this instance is estimated to mean a saving of $20,000 per year in fuel bills alone, not to speak of the difference in depreciation, etc., in steam plants and motor equipment.

A French Transmission System.

By J. J. Green.

La Société Energie Electrique du Littoral Mediterranéen controls and operates the largest electric energy transmission installation in France. Its lines extend from Montpellier to Monaco near the Italian line, a distance of about 200 miles. There are seven small water power plants located on the rapid streams that come down from the mountains near the coast. In the larger cities, Nice, Marseilles and Toulon, they have steam plants which are usually operated in parallel with the

POWER HOUSE UNDER VIADUCT, NEAR NICE.

transmission lines. The highest voltage used on the lines is 50,000. All are three-phase and the standard frequency is 25 cycles.

In this country one finds many odd combinations of the old and the new, as at Tarasçon, where a high-tension transformer is installed in a niche in a big square tower at the side of one of the gates in the fifteenth century wall which surrounds the city. At Nimes and Arles the poles and wires are close to the ruins of buildings constructed by the Romans. In little old towns like Vence the transformers are installed in old buildings on crooked, narrow streets. In most places, however, small transformer houses of stone have been built.

A typical plant is the one located on *le Loup*, a swift stream near Nice. The power house is built at the bottom of a gorge under the great stone viaduct of the Southern France Railroad. The water from this mountain stream is brought in stone conduits along the face of the cliffs a distance of about three miles, nearly all the way in tunnels, to a small reservoir half way up the cliff above the power house. In the power house we find the usual switchboards, lightning arresters, etc., which are of American design. There are four units of the same size, also of American design, and supplied by the French Thomson-Houston Company, each of 500-kw capacity, 12,000 volts. The turbines are of Swiss manufacture and are of the impulse type operating under a head of about 820 ft.

The viaduct, the gorge, with its many cascades, the picturesque mountains in this locality, make it one of the most interesting places near the winter resort on the *"Coté d'Azur."* There are orange orchards and olive groves all along the hillsides below the power house. This indicates that they are never troubled with ice in the winter.

The Manufacture of Calcium Cyanamide.

By John B. C. Kershaw.

THE population of the world and its demand for cereal foods grows unceasingly. One of the pressing problems which the modern scientist has to solve is how to increase the efficiency and yield of this earth, without unduly impoverishing it and rendering it valueless for future agricultural use. There are three substances essential to the life of plants, which are being continually taken from the soil by the crops grown upon it, namely, nitrogen, phosphoric acid and potassium. It is absolutely necessary, therefore, if the ground is not to be impoverished, that these substances should be supplied to the soil annually in some form in which they can be assimilated by the plant.

The frequent application and digging into the ground of artificial fertilizer is thus essential to the maintenance of the present population upon this earth. Should the supply of any of these fertilizers fail the results would be most disastrous. It is a curious fact that only a few plants can draw upon the immense reserves of free nitrogen existing in the atmosphere, and that the great majority are dependent upon the combined forms of nitrogen present in the soil for their supplies of this element. Even in the few cases named, the absorption of nitrogen is not direct, but is due to nodules on the roots containing bacteria, and the attempts to cultivate these bacteria artificially have not been very successful. The nitrogen required by the soil in the early days of agriculture was entirely supplied by animal fertilizer. This is of course still largely used, but it is supplemented by nitrogen in the form of two artificial fertilizers: nitrate of soda and sulphate of ammonia.

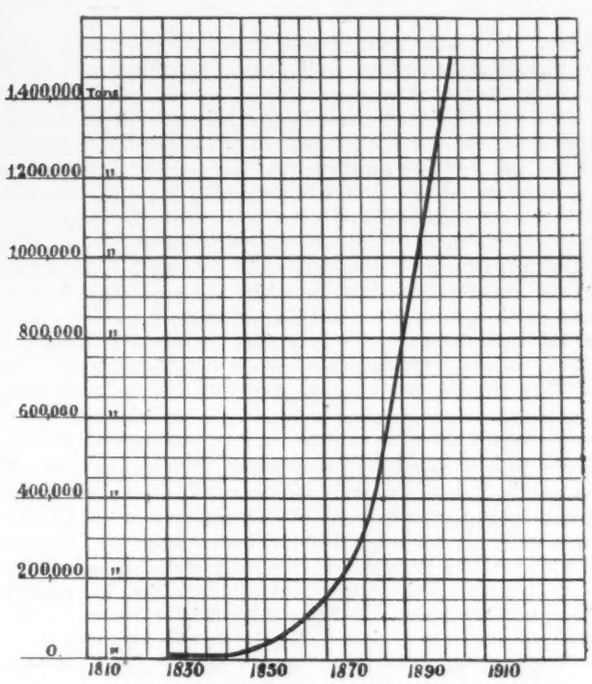


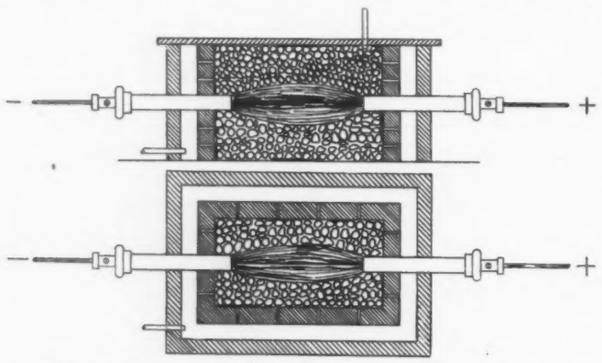
FIG. 1.—WORLD'S ANNUAL CONSUMPTION OF CHILI SALTPETER.

Nitrate of soda or Chili saltpeter, as it is known to the trade, is found as a natural incrustation on the surface of the ground in Chili, and the refined product is now imported in exceedingly large amounts into Europe. How large and important this importation has become is shown by Fig. 1,* in which the world's consumption of Chili saltpeter, for the period 1850-1903, is plotted in graphic form. The curve there drawn shows that the consumption has increased from 250,000 tons in 1850 to 1,540,000 tons in 1903—and that the figures have doubled within the last 13 years. Since these natural deposits of nitrate of soda occur only in Chili, and are of limited extent, it requires no prophet to foretell their exhaustion at an early

*Taken from a paper by Dr. Erlwein—read in Berlin in 1905.

date. In fact, Sir William Crookes, in his presidential address before the British Association at Bristol in 1898, uttered a solemn warning on this subject and pointed out the seriousness of our position unless some new source of nitrates could be discovered.

Although the second artificial nitrogenous fertilizer named above, namely, sulphate of ammonia, is now manufactured in very large amounts as a by-product in gas works and also in the new Mond-Power-gas generating stations, it is quite unlikely that this source of combined nitrogen can ever take the place of Chili saltpeter. The ratio in which the two substances are used at the present time in Germany (the largest user in Europe of artificial fertilizers) is as 2 to 5; the consumption of ammonium sulphate in the year 1904 being estimated at 202,000 tons and that of Chili saltpeter at 500,000 tons. The production figures of sulphate of ammonia and nitrate of soda for the whole world are, however, in the ratio of 1 to 4.



FIGS. 2 AND 3.—FRANK'S CALCIUM CYANAMIDE FURNACE.

Even should the general adoption of Mond-gas, or other systems of the same kind for industrial purposes result in the recovery of more than 50 per cent of the nitrogen in the coal burned annually in all countries for industrial purposes, it is more than doubtful if the whole of the demand for nitrogen for the soil could be supplied from this source. Further, our coal reserves are themselves being rapidly depleted, and thus both sources from which at present we draw our supplies of combined nitrogen for agricultural purposes are failing, and are certain at some future date to be exhausted. The future for the electrical processes, by which the practically limitless store of nitrogen in the atmosphere is drawn upon for supplying this need, is therefore a great one.

Two distinct methods and processes have been devised for achieving this fixation of atmospheric nitrogen by the aid of electric heat, and are now working upon an industrial scale. In the first of these, an electric arc flame is employed to produce nitrous compounds by combustion of the nitrogen of the air, and the gaseous mixture of nitrous oxide and nitric oxide, after cooling, is absorbed in milk of lime to produce calcium nitrite and nitrate. The Birkeland and Eyde is the most promising of the processes of this class, and it is now being operated upon a fairly large scale at Notodden in Norway, where 2100 horse-power is being utilized in this manufacture.

The second type of process for the fixation of atmospheric nitrogen depends upon its absorption by carbides at a high temperature. The most successful process of this type is that of Frank and Caro, which is based upon the use of calcium carbide as the absorbing medium. The latest information concerning the manufacture of calcium cyanamide or "*Kalkstickstoff*" (lime nitrogen) as it is called in Europe, with some practical notes upon its use as an artificial fertilizer, will be given below.

THE FRANK AND CARO PROCESS FOR THE FIXATION OF NITROGEN.

As now carried out at the large works erected at Piano d'Orta in Italy, this process consists in leading nitrogen into closed retorts containing powdered calcium carbide heated to a temperature of 1100° C. The reaction between the carbide and the nitrogen is an exothermic one and yields free carbon in the form of graphite, which remains distributed in the mass of material and gives the product a black color. The chemical change is represented by the following equation:

$$CaC_2 + 2N = Ca\,CN_2 + C$$

(calcium carbide and nitrogen produce calcium cyanamide and carbon).

The calcium carbide required for the process is produced in the usual manner, by heating lime and coke to a temperature of 2000° C. in electric furnaces of the resistor type. At Piano d'Orta the carbide is obtained from a neighboring works and is not produced in the cyanamide factory; but Frank has patented a modification of the original process which permits lime and coke to be employed as raw materials in place of calcium carbide.

The chemical equation for the formation of calcium cyanamide then becomes:

$$CaO + 2C + 2N = Ca\,CN_2 + CO$$

(Lime and coke and nitrogen produce calcium cyanamide and carbon monoxide.)

Carbon monoxide gas is thus produced in addition to the nitrogen compound, as a result of the reaction. The furnace in which Frank proposed to carry out this reaction is shown diagrammatically in sectional elevation in Fig. 2 and in sectional plan in Fig. 3. It consisted of a brickwork chamber six meters in length by three meters in height and three meters in width, containing an inner chamber constructed with a pigeon-holed wall as shown most clearly in Fig. 3. This inner chamber was filled completely with the crushed and mixed raw materials, lime and coke in the required proportion, and electric heating was provided for by the carbon electrodes and core of finely crushed coke running through the center of the mass. The nitrogen was passed under pressure into the annular space surrounding the pigeon-holed chamber of the furnace and the carbonic oxide gas escaped by the vertical vent pipe from this inner chamber, as shown in Fig. 2.

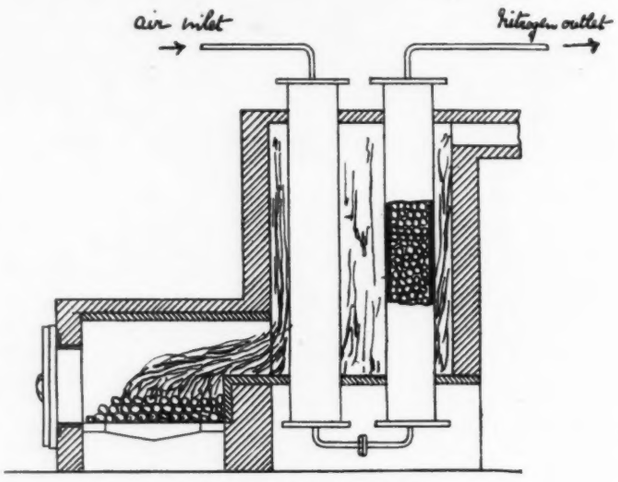


FIG. 4.—NITROGEN RETORT.

Although this method of producing calcium cyanamide is practicable, it has not been adopted at Piano d'Orta, the carbide of calcium required for this works being produced very cheaply by a neighboring carbide works. The nitrogen required for the process can be obtained either by passing air over heated copper (contained in retorts as shown diagrammatically in Fig. 4) or by the fractional distillation of liquid air produced by the Linde process. The latter method has been found the most successful and has been adopted at Piano d'Orta.

The air is freed from moisture and is then compressed and cooled to a temperature of 194° C.—under these conditions of great pressure and low temperature it assumes the liquid state.

The liquid air is now subjected to repeated fractional distillations in apparatus similar to that used in the spirit industry, and is separated by this treatment into its constituents, oxygen and nitrogen. The oxygen gas is compressed and sold in steel cylinders for various purposes, while the nitrogen is employed

directly in the cyanamide manufacture. The furnace in which the absorption of nitrogen occurs is shown diagrammatically in Fig. 5. The carbide broken down to a suitable size is packed into an iron retort, provided at each end with removable covers for charging and discharging purposes. This retort is placed horizontally in a furnace, and the temperature is raised to the requisite value either by the combustion of the solid fuel or by electric heat.

Nitrogen gas is then passed under pressure into the closed retort and the absorption commences with a marked rise in the temperature due to the exothermic nature of the reaction. When no more nitrogen is absorbed, the contents of the retort are withdrawn and are allowed to cool in an inert atmosphere. The lumps of calcium cyanamide are finally crushed to a fine powder which is packed in sacks for sale.

The exact details of the method of manufacture and of the plant employed are at present withheld from publication, and the above are only the broad lines of the process as carried out at the large works erected at Piano d'Orta in Italy and put into operation in December, 1905. It is probable that the retorts and furnaces are of more complicated design and structure than shown in Fig. 5 and that mechanical methods of charging and discharging the retorts are employed in order to reduce labor costs.

The process of manufacture is in fact closely allied to that employed for the production of coal-gas, with the important

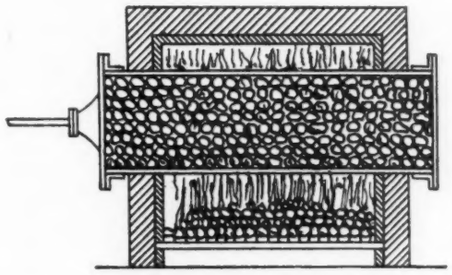


FIG. 5.—FURNACE FOR ABSORBING NITROGEN.

difference that gas is absorbed in place of being evolved. The methods of work and design of plant suitable for the one manufacture would appear to be therefore suitable with modifications for the other. It is noteworthy, however, that some of the chief economies in coal-gas works in recent years have been connected with the design setting and working of the retorts used for distillation, and that mechanical methods are now largely employed for this latter work. That they will be ultimately adopted in cyanamide works is therefore certain.

As regards the output of the Piano d'Orta Works, the writer is informed that six furnaces, each containing five retorts, have been erected, and that large extensions are in progress. Each retort is capable of utilizing three charges of 100 kgs. (220 lb.) of calcium carbide per day of 24 hours, the weight of the charge increasing one-fourth by the nitrogen absorbed, or to 125 kg. The present carbide consumption of the Piano d'Orta Works is therefore at the rate of about 3000 tons per annum, and the output of calcium cyanamide is one-fourth more, or about 3750 tons per annum.

As regards the industrial development of the calcium cyanamide process in Europe, it may be explained that the company owning the Frank and Caro patents and exploiting the process is the Societe Generale pour la Cianamide, of Rome, and that subsidiary companies for developing the process industrially have been formed in most of the countries of Europe and also in America.

The Italian company which has erected the Piano d'Orta Works is named the Societe Italienne per la Fabbricazione di Prodotti Azotati, and as already stated, this company has decided to largely increase the equipment of its present plant at this place. It is also stated to be planning the erection of factories at Fiume and at Sebenico upon the borders of the Adriatic.

In France a company named the Société Française des Produits Azotés has been formed, and works are to be erected at Notre Dame de Briançon, while another subsidiary company is about to introduce the manufacture into Switzerland at Martigny.

The English and Scandinavian patents have been bought by the Northwestern Cyanamide Company, and a large factory is now being erected by this company at Odda, upon the Haardanger Fiord, in Norway. The writer is informed that the initial output of the Adda Works will be at the rate of 12,000 tons per annum.

As regards Germany, the Bavarian government has granted a concession to the Cyanid Gesellschaft of Berlin for utilization of the waters of the Aly at Tustberg in southern Bavaria for this manufacture. The Siemens-Schuckert Company, as part owners of the patents, are interested also in this development, and it is expected that 15,000 horse-power will be ultimately devoted here for the manufacture. A second cyanamide factory is being erected by the same three companies at Bromberg, in Posen, where 2000 horse-power is available.

Negotiations have also been completed for introducing the manufacture into America, and the American Cyanamide Company is about to erect a factory at Meesde Shoels in northern Alabama.

These facts relative to the projected industrial development of the Frank and Caro process for the manufacture of calcium cyanamide, prove that those financing and exploiting the process have faith in the profit-earning capacity of these works, and that they have expectations of a big future for the new industry. Time will prove whether these expectations are to be realized.

MODIFICATIONS OF THE ORIGINAL FRANK AND CARO PROCESS.

Polzeniusz has suggested the addition of calcium chloride (CaC_2) to the carbide used in the retorts. A mixture of 23 per cent calcium chloride with 77 per cent carbide has been found to absorb the nitrogen at a much lower temperature—(from 700° to 750° C.)—and thus to reduce the operating costs of the process. The disadvantage of this addition is that the calcium chloride remains unchanged, and being hygroscopic it confers the same character upon the finished product. It is therefore impossible to keep dry the cyanamide made with this addition when stored unless packed in air-tight drums or kegs. Carlson, however, has improved upon the suggestion of Polzeniusz by substituting calcium fluoride or (fluor spar) for the chloride. This chemical has the same effect in lowering the temperature at which the absorption of nitrogen occurs, while it is free from the hygroscopic defect of the latter salt. Whether this modification of the process will be adopted depends largely upon the relative costs of fuel, calcium fluoride and electricity generated from water-falls in the localities where the industry is started. In some localities it may pay to add calcium fluoride to the carbide while in others it may be more economical to use additional electric energy or fuel required to carry on the reaction at the higher temperature. No hard or fast rule can therefore be laid down as to which is the better process of manufacture.

It is a curious fact that pure calcium carbide does not absorb nitrogen, and that the presence of some other compound of lime is necessary to start the absorption process. In commercial calcium carbide this other compound is supplied by the lime (CaO), which always exists as an impurity in the commercial product. Foerster and Bredig, who have sought to explain why these additions are necessary, assume that the chloride or fluoride acts as a solvent and enables the nitrogen to penetrate more easily the whole of the mass of carbide.

It has also been suggested that producer-gas, which contains up to 50 per cent nitrogen, would be cheaper than nitrogen obtained by the Linde process, for the manufacture of calcium cyanamide. The presence of 12 per cent of carbonic oxide in this gas, however, renders it unsuitable for the purpose, and there is no convenient or economical process known which

would permit of the complete removal of this constituent of producer-gas.

The first modification of the original Frank and Caro process referred to above, in which calcium chloride is added to the carbide, has been employed at a factory in Germany situated at Westeregeln, and owned by the Gesellschaft für Stickstoff-dunger. The product of this factory has been placed on the market and sold under the name of "nitrogen-lime," to distinguish it from the "lime-nitrogen" of the Italian works at Piano d'Orta. It has been stated by Hendrick that the output of the Westeregeln works is at the rate of 5000 tons per annum, and that the product is now being introduced into this country. The writer is informed, however, that the German courts have declared the modified process to be an infringement of the Frank and Caro patents and that the continuance of the manufacture of "nitrogen-lime" at Westeregeln is doubtful.

COMPOSITION AND COST.

Calcium cyanamide is a compound of the cyanide type, and its chemical formula shows that if it had retained the atom of carbon within the molecule which is set free as graphite during its formation, it would have been a true calcium cyanide or $Ca(CM)_2$. On fusing calcium cyanamide with sodium carbonate, this change is in fact brought about. As placed upon the market, calcium cyanamide is a fine, black, heavy powder, containing from 55 to 57 per cent of the cyanamide, and from 19 to 21 per cent of nitrogen. It is about equal in respect of its nitrogen content to sulphate of ammonia. The "nitrogen-lime," made at Westeregeln by the modified process, has a marked tendency to absorb moisture and increase in weight. The percentage of nitrogen in this product therefore will be lower the longer it is stored, although no actual loss of nitrogen is occurring. Hendrick has published an analysis of "nitrogen-lime" showing it to contain 18.35 per cent nitrogen and 5.81 per cent calcium chloride, while the average of two analyses of lime-nitrogen showed 19.35 per cent nitrogen. Both forms of calcium cyanamide have a peculiar odor due to the acetylene gas which is liberated from the undecomposed carbide, when they become damp, and both forms absorb carbonic acid from the atmosphere owing to the free lime which they contain.

As regards costs, no very reliable figures based on actual working have yet been published.

The cost of energy is in fact the determining factor in the cost of the new product, and where this can be very cheaply devoloped, say for $10 per hp-year, the prospects for the new industry would appear to be promising. Dr. Erlwein has stated that one ton of nitrogen can be obtained in the form of calcium cyanamide by the Frank and Caro process for an expenditure of two kw-years, but whether this estimate covers all the energy requirements of the works is not clear. On the same authority the cost of producing nitrogen from liquid air at Piano d'Orta is about one cent per cubic meter, when using electric energy costing about six cents per kw-hour.

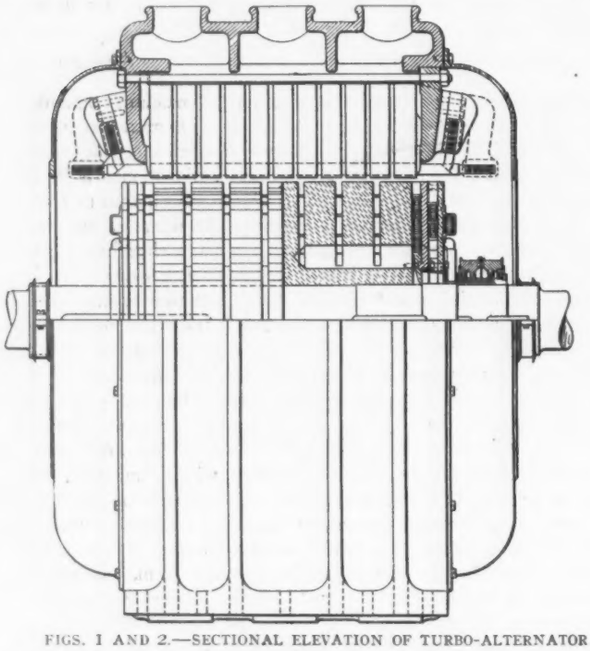
At present the chief aim of the promoters of the calcium cyanamide industry is to obtain a trial upon a widely-extended scale for the new artificial fertilizer, and to this end the selling price has been fixed so that it may be slightly cheaper than either sulphate of ammonia or nitrate of soda per unit of available nitrogen. No sales of the product are, however, being made in the United Kingdom, as there is no supply of cyanamide yet available. It is hoped that the Odde factory will commence to produce cyanamide early in 1908, and the price of the product is to be cheaper than ammonium sulphate of the same nitrogen contents. The present market price of the sulphate is $60 per ton.

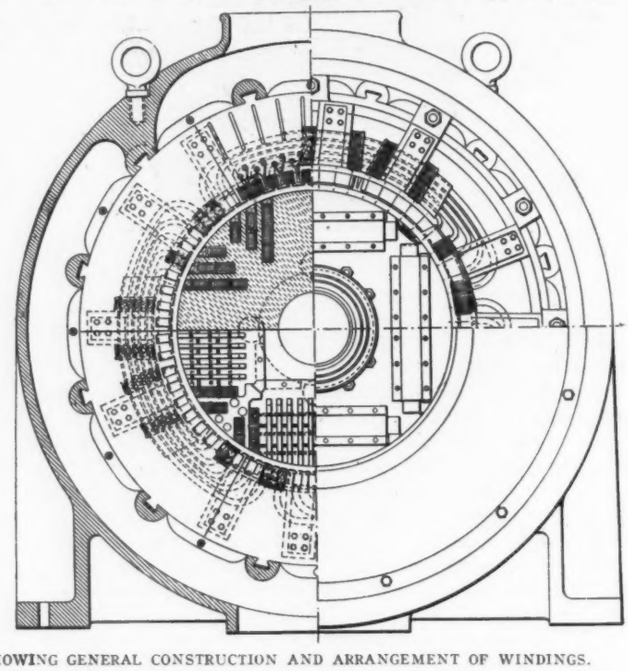
Turbo-Alternators of the Corporation Electricity Works, Wolverhampton, England.

In the extension of its generating equipment, the Corporation Electricity Works, Wolverhampton, England, have installed two 1000-kw turbo-alternators which possess many points of interest. Special efforts have been made to obtain a solid construction of the rotor, so as to avoid wind friction and reduce the noise.

The rotor is of the cylindrical smooth-core type, with distributed windings in open slots, and the actual core consists of a solid block of steel weighing about 8000 lb. A special feature of the design is that the slots are sunk in the direction shown in the sectional drawings of Figs. 1 and 2. One of the advantages of this method is that the former-wound coil can be placed directly in the parallel slots without disturbing the form of the coil. The winding in each slot is sub-divided into two or three sections, according to the depth of the slot, and each section is kept in position by phosphor-bronze wedges. The end connections of the field coils are secured by strong steel plates and phosphor-bronze keys, and each element is thus supported individually. The field winding consists of a flat strip wound on edge and compressed after having been placed in position.

This arrangement renders the rotor not only particularly strong mechanically, but it is capable of being very accurately balanced, and when once balanced there is little possibility of the distribution of weight altering.





FIGS. 1 AND 2.—SECTIONAL ELEVATION OF TURBO-ALTERNATOR SHOWING GENERAL CONSTRUCTION AND ARRANGEMENT OF WINDINGS.

The machine is protected by the strong cast-iron frame of the stator. This is provided with air suction and delivery openings, cold air being drawn in at the base and ends of the machine and discharged from chimney-shaped openings at the top. This scheme of ventilation is favorable to noiseless running.

The stationary armature winding does not differ materially from other designs of turbo-alternator, but it should be said that the arrangement of the end-connections is particularly neat, and at the same time great care has been taken to secure them rigidly in place, a question to which too little attention was paid in the early days of high-speed machinery. Each coil is held in position by two strong brass brackets. Speaking generally, the machines are compact for their output, and the attention that

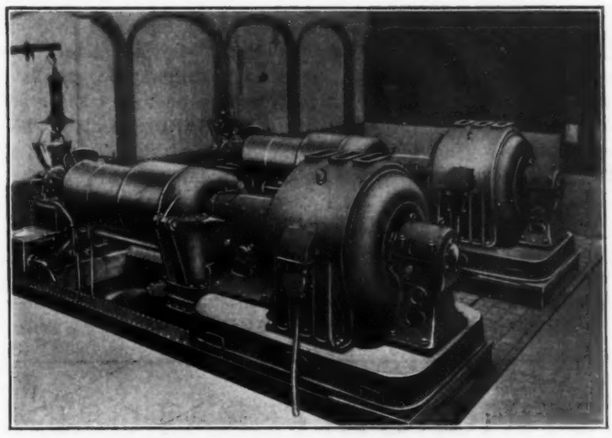


FIG. 3.—GENERAL VIEW OF TURBO-ALTERNATORS.

has been paid to their balancing is shown by their remarkably quiet running and freedom from vibration.

The above-described alternators were built by the Electric Construction Company, of Wolverhampton. They are directly-connected to Parsons turbines, built by Willans & Robinson, of Rugby, England. The turbines consume from 17.1 to 18.1 lb. of steam per kw-hour when the alternators are delivering full load at a power factor of 0.85, according to the temperature of the condensing water. The alternators are designed for 6600 volts and 50 cycles, the speed being 1500 r.p.m. It is stated that the efficiency at unity power factor the efficiency varies from 0.895 at half load, 0.92 at three-fourths load and 0.94 at full load to 0.95 at one and one-half full load.

New Telephone Patents.

CABLE TERMINAL.

Mr. F. B. Cook has obtained a patent for a new cable terminal. The cable is to be potheaded and placed within the metal frame of the terminal. This frame has an upper and lower ring, each carrying a ring of insulating material. These latter extend toward each other nearer than the metal rings and form mountings for the two ends of the various protectors. The protectors comprise a mounting carrying a fuse and carbon plate and are adapted to be mounted upon the rings. The pothead wires lead directly to the protector terminals. One of the special points of design lies in three radial, vertical flanges which hold the upper and lower rings in proper relation and at the same time afford a guide for the cylindrical cover.

SIGNALING SYSTEM FOR DIVIDED SWITCHBOARDS.

W. W. Dean has obtained a patent for a signaling system for a common-battery divided-multiple switchboard. The system is suitable for an arrangement of the multiple in four sections, an answering jack and line signal for each line appearing at each section, and under selective control of the stations. Mr. Dean has provided four line relays, two in each side of the line. One of these relays is more sensitive than the other, and will work upon a current where the other fails. This affords a means of selection. Where both relays on one side work together, one signal is displayed, and when a resistance is included at the calling station, and one relay fails, another signal is displayed. The patent for the arrangement is assigned to the Kellogg Switchboard & Supply Company.

LINE PROTECTOR.

For a considerable time there has been upon the market a type of branch line fuse adapted to clamp directly to the open main line. These have been largely used, but recently their sphere has been limited because of the recognition of the

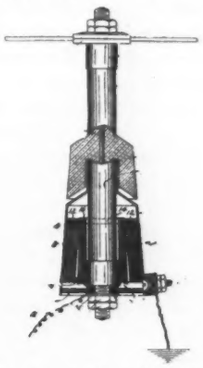


FIG. 1.—COOK PROTECTOR.

necessity for an open space cut-out in addition to the fuse in many cases. To obviate this difficulty Mr. F. B. Cook, of Chicago, has produced and patented the line fuse shown in Fig. 1. A petticoat is formed upon the body of the fuse shell, beneath which is placed a conical metal ground plate. The carbons slip over the fuse. The outer fits the ground plate and has a tapered base. The inner is cylindrical, thus forming a V-section air-gap affording a clear path for falling carbon dust.

COMPOSITE SYSTEM.

While a practical solution of the problem of simultaneous transmission of telegraph and telephone messages over the same line has long been known, the adaptations of it to railway working have opened so large a field that great attention is now being paid to the subject. Railway working, of course, presents conditions far different from those of the general leased wire, principally because of the many intermediate stations and the calling-up requirements. Because of this, special sets have had to be devised for this service. Many different circuit schemes have

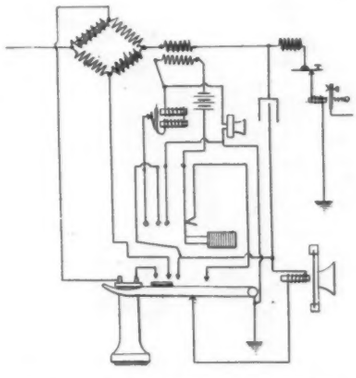


FIG. 2.—RUGH COMPOSITE SYSTEM.

been proposed. One of the most recent is shown in Fig. 2. This is the invention of H. O. Rugh, of Sandwich, Ill.

It will be seen that a four-arm bridge is inserted in the telegraph line. Two diagonal arms are non-inductive and two inductive. The telephone and a condenser are connected across the middle. For telegraph currents which have passed through a smoothing impedance, the telephone connects virtual equipotential points. The alternating telephone currents meet such high impedance in the inductive windings of the bridge that practically all of them must pass through the telephone bridge.

The telephone signaling device includes a vibrator for sending out high-pitch currents for calling and a megaphone receiver for receiving the incoming calling currents.

Letters to the Editors.

Electromagnetic Force.

To the Editors of Electrical World:

Sirs:—In their "Letters to the Editors" in the issue of the Electrical World for April 25, Messrs. Hering and McAllister make use of the expression $f = H l i$ to represent the force on a conductor in a magnetic field. Although this formula is found in many text-books, it is not correct and should be discarded. The proper formula is $f = B l i$.

If the former formula were correct, one would always attempt to use diamagnetic materials as conductors and insulation for armature conductors, so that H might be made as large as possible for certain flux per unit area, B. We know that it is always B (and never H) that determines the force on conductors and the e.m.f. produced by moving conductors. B and H should not be confused. B and H are totally different kinds of quantities whose ratio μ is the permeability.

Ann Arbor, Mich. Geo. W. Patterson.

To the Editors of Electrical World:

Sirs:—The statement made by Prof. Patterson with reference to the distinction between magnetic force, magnetic flux and permeability is correct in every detail. However, his criticism seems not to apply with great emphasis to the letters mentioned above, because each of the writers stated definitely that the force varies with the *flux density* of the main field, thereby giving to the symbol H the exact physical significance that Prof. Patterson evidently assigns to B.

New York, N. Y. A. S. McAllister.

The Rights of the Inventor.

To the Editors of Electrical World:

Sirs:—I have taken no part in the interesting discussion of the patent system, because it seemed wiser to leave it to the inventors and manufacturers who have, or think they have, cause for complaint, so that real objections may be developed, and if possible remedied.

I am moved to break silence, however, by the letter of Mr. Chalmers, who complains that he cannot get for minor improvements the claims which seem to be granted for similar improvements to others. This involves two questions, the first of which is, whether Mr. Chalmers is entitled to the claims he seeks. The second question it may be permissible to suggest and to answer by the well-known anecdote concerning the famous Dr. Abernethy. It is related that a noble lord once attacked him at a social function, and describing his own symptoms as a hypothetical case, said: "Now, Doctor, what ought the patient to take?" "Take!" said the shrewd old Scot, "I should judge he ought to take medical advice."

New York City. T. J. Johnston.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Modified Cascade System.—A. Heyland.—The conclusion of his illustrated article, the first part of which was abstracted in the Digest last week. The author describes a third system which is intended to combine the advantages of the two systems

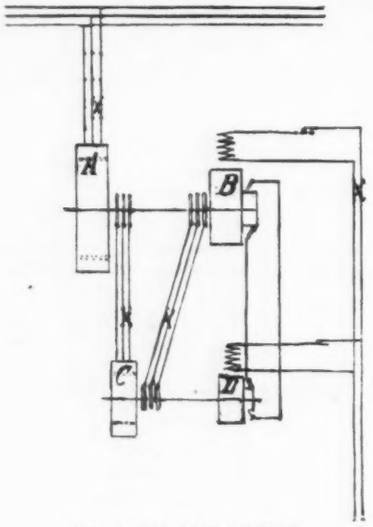


FIG. 1.—CASCADE SYSTEM.

described before. Its arrangement is shown in Fig. 1. A is the main working motor, B the secondary working motor which is a direct-current motor, but is equipped with three slip rings. C is an auxiliary motor which acts also as a frequency converter; it has three slip rings which are connected to the slip rings of B. Coupled with C is the auxiliary machine D, which is a direct-current machine connected to the commutator of B. If the two direct-current machines are not excited, the machine C runs as an induction motor with a small slip, the currents due to the slip being closed over the armature of B. For the first starting of C as an induction motor, the connection of its slip rings with B is broken and the slip rings are closed over the resistors. While A and B are at rest, the switches are then turned in one or the other direction of rotation and the direct-current machine D is excited to a certain amount. One-half of the current given off by this direct-current machine then passes over the armature of the direct-current motor B and the other half over the rotor of C and excites this machine. The slip of C is thereby reduced to zero and it then runs as an unloaded synchronous motor and the current supplied to the motor may then be chosen so that the phase difference in the primary circuit is just compensated. To start the two working motors A and B, the motor B is gradually excited to its full constant excitation and the exciting current of the direct-current machine D is increased. As soon as the working motors start, the speed of the two auxiliary machines C and D decreases and B runs simultaneously as a direct-current and an alternating-current motor, the direct current being supplied from D and the alternating current from the rotor of C. The machine C acts simultaneously as a motor and a frequency converter with variable transformation ratio. The advantages of this system are discussed with special reference to hoisting in mines, and to single-phase traction on railroads.—*Elek. Zeit.*, April 9.—A somewhat different discussion of the

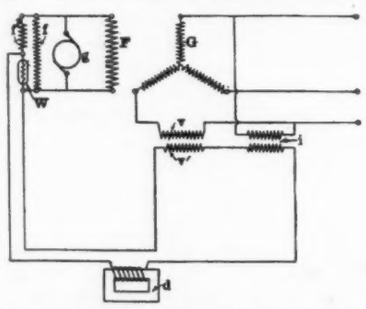


FIG. 2.—COMPOUNDING OF ALTERNATORS.

three systems is given in an article by A. Heyland on frequency transformers in Lond. *Elec.*, April 10.

Compounding of Alternators.—An illustrated note on a method devised by Ganz & Company. It is shown in Fig. 2. G

is a generator the field circuit of which F is fed from the small exciter g. The field coils of the latter are made up of two winding f and f^1 connected in parallel, while a resistor W is placed in series with the coil f^1. The ends of this resistor are connected through a choking coil d to the secondary windings of the transformers i and v^1, these windings being in series. The former of these i operates as a shunt transformer, while the latter v^1 works as a series transformer. When the load on the generator increases, the secondary current also rises and with it the drop across the resistor W. The result is that the effect of the second winding f^1 is diminished, so that the excitation of the generator and, therefore, its voltage, increases.—Lond. *Elec.*, April 10.

Three-Phase Motors.—A communication by Bragstad discussing some points in a recent article of Simons and Vollmer on the wave form of the currents in three-phase motors and the separation of the losses; with a reply by Simons.—*Elek. Zeit.*, April 2.

Lamps and Lighting.

Necessary Precautions in the Use of Artificial Illuminants.—Some further notes on the researches made by Schanz and Stockhausen, which have been noticed in the Digest, on the precautions which should be taken to protect the eye from detrimental defects of artificial light. As a result, it would appear that the disease known as "electric ophthalmia" ("arc eye") is caused by the ultra-violet rays, and that these rays, while not visible to the naked eye, are particularly energetic in their action, as is shown by photography. The ordinary lenses of spectacles, or the shades of lamps, absorb only ultra-violet rays of less wave-length than 300 microms; that is the least dangerous, while allowing those of greater wave-length to pass. Blue glasses are no protection, as the ultra-violet rays easily pass through, neither do dark glasses intercept, but only weaken them. The following recommendations are made: All lamps should be fitted with diffusing shades, so that illuminated parts whose brightness exceeds 0.75 hefner per square centimeter are not in the line of vision. The globes or shades should be made of a glass that will absorb the ultra-violet rays. They should be of sufficient thickness and constructed in such a way that they wholly surround the lamp, giving a uniform illumination. Incandescent lamps with clear globes should not be used for lighting workshops or schools. Indirect lighting is preferable to all other systems.—Lond. *Electrician*, April 10.

Generation and Transmission.

Water Storage for Energy Transmission.—A long and fully illustrated description of the Urft Valley water reservoir in Western Germany, which is at present the largest artificial basin for storing the rain deposits of a larger area (375 sq. km.) in order to prevent floods and to utilize the water power for the production of electrical energy for transmission over an industrial district. The power house is designed for eight 8000-hp generating sets, but only six have so far been installed. Each generator has a rating of 1600 kilowatt amperes, producing 50-cycle, three-phase currents at from 5000 to 5400 volts, the speed being 500 r.p.m. In the present installments the hydraulic plant, the machine plant and the switchboard are described. The transmission e.m.f is 35,000. The length of the high-tension lines was 166 kilometers in May, 1907, and that of the low-tension mains 238 kilometers. The total cost of the plant and transmission line is about $2,500,000. The storage basin alone costs $1,000,000; that is, 2.25 cents per cubic meter of water. The paper is to be concluded.—*Elek. Zeit.*, March 19, 26 and April 2.

Proposed Energy Distribution in Ireland; Use of Peat.—An account of the Dublin & Central Ireland Electric Power Bill which is now before a committee of the British House of Commons. The proposition is to supply electrical energy over three counties in Ireland. Gas engines will be used in connection with 500-kw generating sets, and the utilization of peat as fuel. The promoters estimate that the cost of fuel will be 0.1 cent per kw-hour, which is compared with the lowest cost for fuel in England at steam generating stations; namely, 0.26 cent at Newcastle and 0.38 cent at Salford. It is estimated that there is sufficient peat in the area to give 35,000 horsepower for 300 years. Capt. H. Riall Sankey, who gave evidence on behalf of the promoters, stated that whereas it was estimated that the cost of the peat would be $1.01 per ton, the return by the sale of the by-products, sulphate and ammonia, would be $0.97 per ton, and other minor by-products were estimated to produce a similar amount, but he thought it would not pay to install the plant necessary for dealing with the by-products unless a load of 10,000 kilowatts was obtained. In this event the quantity of peat burned would result in 650 tons of sulphate of ammonia.—Lond. *Elec. Eng'ing*, April 2.

Generating Station of Copper Refinery.—F. D. EASTERBROOKS.—A detailed and fully illustrated description of the generating station of the new addition of the Raritan Copper Works. In electrolytic copper refining cheap energy is important, since the energy cost is 40 per cent of the whole tank-house cost from anode to cathode with the present multiple system, while the energy cost is approximately 23 per cent of the total cost of refining copper from pig to wire. Relatively cheap energy can be obtained even with steam engines, since the load curve is absolutely uniform throughout the 24 hours. In the new addition to the Raritan works, the three electrolytic circuits in the tank house are supplied with energy from four steam-engine-driven 870-kw generators. The maximum current is 7500 to 8000 amperes.—*Electrochem. and Met. Ind.*, May.

Telpherage.—M. BUHLE.—An illustrated article on modern systems of transportation of freight by means of suspended railways with a single rail. The electric system is preferable if the track has an irregular form, but for grades steeper than 1 to 20 it is not recommended. For steeper grades an endless cable should be used, which is also preferable when the track is quite regular, for instance, when it consists of two parallel straight roads. Several installations of this kind are described, especially with electromotives hauling a number of freight cars.—*Stahl u. Eisen*, Feb. 26.

Feed-Water Heater.—J. GOODMAN AND D. R. MACLACHLAN.—A paper read before the (Brit.) Inst. Mech. Eng. on tests made with respect to the advocacy by Wilkinson of the live-steam feed-water heater. The authors find that in the particular arrangement used by them, which was not that of Wilkinson, there was no gain in efficiency by the live-steam method over the use of cold feed water, but there was an advantage in obtaining the scale outside the boiler instead of within.—Lond. *Elec.*, March 20.

Traction.

Booster.—W. WEISSBACH.—An illustrated description of the reversible booster of Pirani, as built by the Siemens-Schuckert Company. The arrangement is shown in Fig. 3. A is the

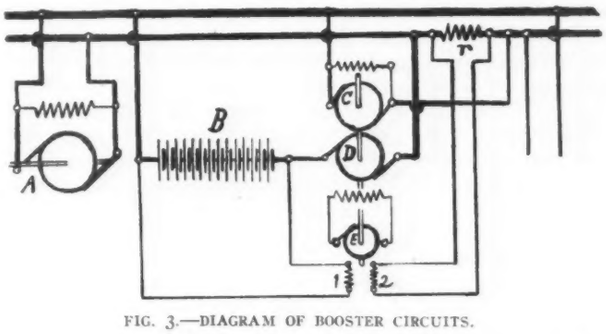


FIG. 3.—DIAGRAM OF BOOSTER CIRCUITS.

railway generator, B is the battery, which is in series with the dynamo D of the motor-generator set of the Pirani booster system C D E. The exciter E has two excitation windings *1* and *2*. No. *1* is connected to the terminals of the battery B, and *2* is connected to the terminals of a resistor r in the return circuit of the network. The two windings of *1* and *2* are so joined that their magnetizing effects are opposed to each other. If the network is unloaded the excitation winding *2* carries no current and the exciter E is excited by *1* alone. The battery B is then charged by D. If now the load on the network increases electricity will flow through *2*, and the effect of *2* will be opposed

to that of *1*, so that less charging current exists in *B*. If the current in *2* further increases, a point will be reached at which the effects at *1* and *2* will just be balanced and the battery *B* will be neither charged nor discharged. If the current increases still further *B* will be discharged. If the current through *r* changes its sign, as is the case with roads employing recuperation of energy, the current through *2* will be reversed and the effects of *1* and *2* are added to each other, thus acting toward an increased charge of the battery. Since the voltage of the battery decreases during discharge and increases during charge, this variation of voltage of the battery aids the action of the booster toward stronger discharge or charge. With the former arrangement the booster generates the same positive or negative voltage when the exciter *E* has the same positive or negative voltage. It has, however, not been found satisfactory in practice to have the same positive and negative characteristics of the booster. To overcome this disadvantage an iron-aluminum cell is used in parallel with *r*. As is well known, it permits electricity to pass in one direction, but not in the other, so that in one case electricity will pass partly through *r* and partly through the iron-aluminum cell and in the other case only through *r*. According to the way in which the iron-aluminum cell is connected to *r*, it is possible to decrease the current in one direction at will and to leave the current in the other direction unchanged. Various diagrams show the results obtained with this arrangement in practice.—*Elek. Kraftbet. u. Bahnen,* March 24.

Berlin.—J. W. van Heys.—An article discussing possibilities of increasing the traffic capacity of the Berlin Stadt & Ring Bahn, especially by a modified construction of the cars.—*Elek. Kraftbet. u. Bahnen,* March 14, April 4.

Installations, Systems and Appliances.

Price of Electricity Supply and Hours of Burning Lamps.—G. Dettmar.—A reduction of the rate of charging for electrical energy results in an increase of connections and in a better utilization of the existing connections by increasing the number of hours for which they are used. The latter effect is discussed by the author on the basis of statistical data from 151 German central stations. These data show that the number of kw-hours sold per kw-rating of the station is practically independent of the size of the city and is also independent of the existence of a gas plant in the city. It naturally depends, however, on the character of the city (whether chiefly industrial or residential, etc.) and also depends greatly on the rates. The results of German stations have shown that it will often be advantageous for a station to considerably reduce the rates. While a station which charges a high rate would suffer a loss by reducing the rate only a little, it will feel the advantages of a low rate if quite a considerable reduction is made. The introduction of the metallic-filament lamp which consumes practically one-third the number of watts per candle-power, compared with the carbon lamp, is really equivalent to a reduction of the price of the energy. Nevertheless, the author thinks that many German stations could still further reduce the price. Since the new lamps at ordinary voltage are not made for small units of candle-power their introduction reduces the energy consumption practically only to one-half, instead of one-third. If, at the same time, the price for electrical energy (which is now in Germany generally from 9 to 11 cents for lamps and from 4 to 5 cents for motors) is reduced to from 60 or 70 per cent of the present price, no bad financial results will be experienced. On the other hand, statistics shows that there will be a large increase of the hours for which the existing connections are used, thus improving the load factor. Further, there will be a considerable increase in new connections. Of course, local conditions must be taken into account. It may then be possible to compete successfully with gas incandescent lamps, even of the inverted type.—*Elek. Kraftbet. u. Bahnen,* March 14.

Earth Return.—An account of the report of the earth-return commission appointed by the Swiss Association of Elec. Engs. The report, which is signed by Prof. Wyssling, discusses the use of the earth as return in direct-current circuits, with special reference to the transmission from Saint Maurice to Lausanne, where the Thury series constant-current system is used. The experiments were made with a constant earth-return current of 150 amperes. The chief results are as follows: By relatively simple means and with a relatively small cost it is possible to provide, even in a somewhat unsuitable location, satisfactory earth connections which have not too high a transition resistance (about 0.3 ohm). If the dimensions and number of the earth connections are not considered, the nature of their construction has little influence on their resistance, but it has a great influence on the lasting qualities of the connection, which is, of course, of great importance. These earth connections do not subject persons in the neighborhood to any danger, at least with direct current. The potential difference per meter distance is about 10 volts. The principal part of the resistance of the total earth circuit is in the neighborhood of the earth connections themselves. There seem to result, however, troublesome effects on railroad block-signal systems and on telegraph lines using earth return.—*L'Industrie Elec.,* March 25.

Protective Relays.—M. C. Rypinski.—A continuation of his illustrated serial, describing polyphase alternating-current overload relays for inverse-time-element action.—*Elec. Jour.,* April.

Price of Electric Energy in Sweden.—A note stating that the city of Gothenburg has recently contracted for a large supply of electric energy from the hydro-electric plant at Trollhättan, which is now being built by the Swedish government. The energy is to be delivered at the city limits in form of three-phase currents at a frequency of 25 cycles and at 6000 volts. For the first 7000 kilowatts taken a price of $13.75 per year per kilowatt of maximum demand plus 0.134 cent per kw-hour will be paid. If the city takes more than 7000 kilowatts the fixed yearly price will be raised 12 per cent for the amount in excess. The maximum demand is to be ascertained by a meter showing the highest load during a quarter of an hour. This instrument is to be read every week, and the mean of the four highest readings for the year is to be considered as the maximum demand during that period. The city's selling price to consumers has not yet been settled, for distribution will not commence until January, 1910. The Trollhättan plant at the waterfalls in the Gota River, 44 miles north of Gothenburg, is to be equipped with eight 7000-kw generators, four of which have been ordered from a Swedish company. The 10,000-hp turbines for a head of 100 ft. are also in course of construction by Swedish firms. The energy will be transmitted at a pressure of 50,000 volts on steel towers, the spans being from 500 ft. to 600 ft. For the construction of the plant a sum of $3,105,000 has been appropriated, while for the transmission lines $687,500 will be needed.—Lond. *Elec.,* March 20.

Central Station in South Africa.—P. A. Robbins.—An illustrated paper read before the Am. Inst. Min. Eng., describing in detail the central power station of the De Beers Consolidated Mines of Kimberly, South Africa. The local conditions, especially with respect to adequate water supply and cost of fuel and other supplies, are very onerous and the greatest economy in design, construction and operation was necessary. There are three Westinghouse steam turbines, each connected with a three-phase, 5000-volt, 50-period alternator. Two have a rating of 1000 kilowatts and a third of 1500 kilowatts.—*Bi-Monthly Bull. Am. Inst. Min. Eng.,* March.

Wires, Wiring and Conduits.

Mechanical Properties of Bronze Wires.—G. Nicholaus.—A paper communicated by the German Imperial Telegraph Experiment Station. When telegraph or telephone wries have been placed on poles it is found that after a certain time the sag increases, and there may be danger of two wires touching each other. This is partly due to the gradual straightening out of bends, etc., and partly to the fact of the electric properties of the wire chain. To avoid this it has been tried to subject the wire to a preliminary stretching treatment before placing it on the poles. Figures are given, together with diagrams, on the behavior of bronze wires in comparison with iron wires, and it is shown that there are two possible methods of causing a bronze wire to show perfect elasticity up to a certain maximum

tension. Either the wire is subjected to repeated stretching to the desired maximum tension, or it is subjected to a single stretching operation beyond the desired maximum tension. It is shown that the latter way is unsuitable for practice. In practice the maximum is chosen at about two-thirds of the elastic limit, and a satisfactory preliminary treatment consists in stretching the wire twice slowly up to this maximum tension, which is kept constant for about two or three minutes. Practice has shown that bronze wires treated in this way do not increase their sag in time, while the changes in mechanical and electrical properties of the wire due to this treatment are practically insignificant. It is necessary to subject the wires to the preliminary treatment just before they are placed on the poles, since wires which have been treated that way and are left then without tension for a long time slowly assume their former properties.—*Elek Zeit.*, March 26.

Fuses.—A. SCHWARTZ AND W. H. N. JAMES.—The conclusion of their illustrated paper on fuse phenomena. In the present installment the authors deal chiefly with the time element of fuses and their rating. The rating of a fuse may be determined from a consideration of the permissible temperature rise in the circuit to be protected; the time element of a fuse is, however, dependent upon the heat capacity of the fuse and its immediate surroundings. The time element of a fuse may be defined as the time lapse necessary for the heating of the fuse from the cold state to the fusing point with a given overload. The heat capacity of a fuse may be varied by change in the metal, shape and environment, and these variations may be made use of for altering the time element of a fuse for a fixed rating to a considerable extent. The greatest difference in time element will be between an open fuse of copper and an enclosed fuse of a sluggish metal such as tin or zinc. It is desirable that a definite basis for reference should be established, and the authors suggest the following definition: "The time element of a fuse is that time which is required to heat up the fuse from the cold state until it blows with an overload of 50 per cent reckoned on the normal fusing current of the fuse." For large-size enclosed fuses the time element as defined above would be of the order of four or five minutes. In enclosed cut-outs in which the fuse wire or strip is carried through a hole or slot in the end cap or ferrule and then secured by solder or in a terminal of some sort, it is necessary to protect these holes from damage from the arc. If the distance between the end caps is such that an arc can be set up between them, the hole or slot will either be considerably enlarged or damaged by fusion, or the wire or strip ends will become fused to the caps. This can be prevented by a device in which the fuse wire or strip before entering the hole or slot in the end cap or fuse contact makes contact with a washer or other easily renewable metal piece which is in electrical contact with the end caps or fuse contacts, and is, therefore, at the same electrical potential as they are. The damage will then be confined to the removable metal piece. It would appear advisable to do without free holes or openings in the end caps as far as this is possible as they not only allow of the emission of flame on short circuit, but seem to favor the persistence of the arc. An account is given of the extended discussion which followed the reading of this paper in London and Manchester. In the discussion it was brought out that a sub-committee of the (Brit.) Eng'ing Standards Committee is engaged on the question of the standardization of fuses.—Lond. *Elec.*, March 13.—The whole paper and discussion also in Lond. *Elec. Eng'ing*, March 12.

Standardization of Fuses.—Two letters concerning the advisability of standardization of fuses which is now being attempted in England. A. H. Dykes thinks there is no general demand for such standardization while F. Broadbent goes into the variations in the requirements of fuses for different classes of work, and points out that, before the fuses themselves can be standardized, a standard set of conditions to be complied with must be formulated. An English company has already standardized a series of no-voltage relays for polyphase motor switches.—Lond. *Elec. Eng'ing*, March 26.

Electrophysics and Magnetism.

Electric Discharges Through Gases.—J. J. THOMSON.—His fourth Royal Inst. lecture on this subject, discussing further the mode of electric conduction through gases. The production of new ions by collisions between molecules and ions is dealt with. Reference is made to the fact that for any particular gas pressure there is a preferential easy spark gap. At ordinary (high) gas pressure the spark takes the short path, at very low pressure the long path is easier. A spark requires a certain minimum potential to pass at all, whatever the distance. The minimum potential is not the same for different gases. However, this law breaks down for gap distances comparable to the wave length of light, since two wires making what may be called a bad contact will allow a current to pass at any small potential, although there is always a layer of gas between the two wires. Here a new law comes in which is probably concerned in the phenomena of coherers.—Lond. *Elec.*, April 3.

Electrochemistry and Batteries.

Plating Iron and Steel with Zinc.—S. COWPER-COLES.—A fully illustrated paper on the protection of iron and steel surfaces by means of zinc. The methods of hot galvanizing or dipping, electrolytic zinc plating, "sherardizing" (treatment in zinc dust at a temperature below the vaporization point of solid zinc) and "cowperizing" (treatment in zinc vapor) are described and illustrated and their relative advantages for certain uses are discussed.—*Electrochem. and Met. Ind.*, May.

Electric Zinc Furnace.—J. W. RICHARDS.—In a continuation of his serial on metallurgical calculations, the author discusses the reduction of zinc oxide in the electric furnace, with special reference to the work of Gin and Snyder.—*Electrochem. and Met. Ind.*, May.

Units, Measurements and Instruments.

Artificial Load for Testing.—N. C. OLIN.—In a case of testing alternators connected to waterwheels it became necessary to provide an artificial load. A water rheostat was built as follows: Two frames were first constructed for the top and bottom, exactly alike and in the form of equilateral triangles. Rough pine "two-by-fours" were used for this purpose. Through each corner of these frames a hole somewhat over 2 in. in diameter was drilled, the distance between centers being 2 ft. Then the frames were slipped over three pieces of 2-in. iron pipe, 6 ft. long and securely pinned. Near the top frame each pipe was drilled and tapped for a machine screw to act as a binding post and from each binding post a rubber-covered wire was carried. The bottom of the frame, which was called a rheostat, was then heavily weighted and a tie was made at the top exactly in the center, so that an upright position was assured for the rheostat when in the water, and, therefore, a balanced load between phases. The total weight of the rheostat thus equipped was about 200 lb. A beam, on the end of which a pulley had been attached, was projected from a window and the rheostat was lowered into the tail race below by means of a rope through the pulley. Load regulation was attained by lowering and raising the rheostat; the load was steady and the balance between the phases nearly exact. The author was able to reach nearly 270 kilowatts, 7200 volts, with about two-thirds of the rheostat submerged and would have gone further had it been possible to keep the waterwheel up to speed with greater load. A testing table was rigged up so that the current in any phase could be read on one standard ammeter and the voltage across any phase could be checked on a standard voltmeter. As no cut-outs or circuit breakers were easily available a fuse block was rigged up by placing in each two insulators about 14 in. apart, breaking the wires at these insulators and turning them abruptly upward. Around the skinned ends of each wire, and across the opening between them, a one-ampere fuse wire was strung, giving enough turns to equal in capacity the ampere-load.—*Elec. Jour.*, April.

Selenium Cells.—F. C. BROWN AND J. STEBBINS.—An account of an experimental investigation of the different factors which determine the change of electric resistance of selenium cells. The selenium cell changes its resistance with a change in the

mechanical pressure on its surface. The pressure produces a real change in the resistance of the selenium itself. For the cases described the percentage change of resistance for one atmosphere lies between 0.05 and 0.30. This value is also a function of temperature and the e.m.f. applied in measuring resistance. An increase of pressure or a rise of temperature lowers the light-sensitiveness of the selenium cell. The light-sensitiveness is a function of the resistance of the given cell, whether this resistance be conditioned mainly by temperature, light, radium or hydrogen peroxide. The effect of radium and of hydrogen peroxide is to decrease the resistance very markedly, as much as 35 and 99 per cent, respectively.—*Physical Rev.*, April.

Metric System.—C. E. Guilleaume.—The first part of a serial on recent progress in the metric system. After a general introduction, the author deals with the measurement of fundamental wave lengths, the determination of the mass of a cubic decimeter of water, with standard thermometric scales and the coefficient of gravity.—*L'Ind. Elec.*, April 10.

Telegraphy, Telephony and Signals.

Manufacture of Magnet Coils.—F. Schnaubert.—An illustrated description of the equipment of a large factory for making electromagnet coils for telegraphy and telephony. For testing purposes a bridge is recommended which does not measure ohms, but the percentage deviation from a standard coil. The construction of the bridge and of the galvanoscope which belongs to it are described.—*Elek. Zeit.*, April 9.

Telephone Exchanges.—Stille.—The first part of an illustrated paper read before the Berlin Electrical Society on the equipment of modern telephone exchanges with the central battery system.—*Elek. Zeit.*, April 9.

Miscellaneous.

Commercial Research.—C. E. Skinner.—A review of the work of the research department of a large electrical company. "The addition of new knowledge on any subject is of both permanent and economical value, although the results of such additions may not be apparent until decades after the knowledge has been gained." In working for a large corporation, however, commercial results must be kept in view, no matter how absorbing the work may be from a purely scientific standpoint. The author then discusses different classes of work which fall into the domain of the research department. They are dealt with under the following headings: Investigation of the properties of materials; development and investigation of processes; investigation of phenomena affecting design; determination of results of design; development of new classes of apparatus; critical study of existing designs; investigation of the causes of failures; investigation of crank schemes, scientific fakes, etc. The author then discusses the methods of work. Each investigation, whether simple or elaborate, should begin where a previous one left off, and all the knowledge of the subject that can be gleaned from any source should be taken into consideration. The elaborateness and cost of an experiment should be governed by the necessity of the case and the probable value of the results. No general rule can be laid down for the conduct of commercial research work. Each problem must receive specific attention, and the necessary results must be arrived at with the least possible delay and expense. Some remarks are made on the following methods: Cut and try method; step by step method; try everything method; elimination method; checking theory method, and combinations of any two or more of the above. Whenever a result is obtained, be it positive or negative, its application must be kept in mind. The experimenter who has the most intimate knowledge of the products of his company will be the most likely to produce from his investigations results which can be applied to useful purposes. The keeping of full records of all research work is of fundamental importance, and it is absolutely necessary to make the records very complete. The personal element in the man carrying out a research also determines the success.—*Elec. Journal*, April.

Soldering Materials.—E. Hohler.—An article criticizing some points in a recent paper of Lippmann, with special reference to a comparison between two commercial soldering materials, called Tinol and Fludor.—*Elek. Zeit.*, April 2.

Electric Fire Alarm.—Auhagen.—An illustrated description of a system of acoustic signals for fire-alarm purposes, based on the principle of the phonograph. The transformation of the transmitted electrical energy into sound waves is accomplished by an electromagnetic interrupter.—*Elek. Zeit.*, March 5.

Electric Fires in London.—In a report of the London County Council Fire Brigade it is stated that the number of fires caused by defective circuits in London has fallen from 100 in 1906 to 88 in 1907. The total number of London fires attributed to electrical causes is given as 95, none of which had fatal results, as against 348 due to gas and 329 due to oil and alcohol lamps.—Lond. *Elec. Eng'ing*, March 12.

BOOK REVIEWS.

Aufgaben aus der Elektrotechnik Nebst deren Losungen. By Dr. E. Mullendorff. Second Edition. Berlin: Georg Siemens. 190 pages, 29 illustrations. Price, 3 marks.

The volume is a text-book on applied mathematics, directed to electrical engineering problems. The work is divided into 10 chapters. These deal successively with problems taken from mass-systems, potential theory, Ohm's law, conductor ramification, current distribution, miscellaneous questions, alternating currents, vector methods, least squares, and problems involving transcendentals. The methods employed are algebraical rather than graphical. The author has done good service in bringing to the notice of mathematicians the types of problem that present themselves in electrical applications.

Elektrische Beleuchtung. Volume VIII. By Dr. Berthold Monasch. Hannover: Dr. Max Janecke. 229 pages, 83 illustrations. Price, 5.60 marks.

This volume forms a good text-book on the general subject of electric lighting, including the use of arc lamps, carbon incandescent lamps, Nernst lamps, metallic-filament lamps, and the illumination which these provide. There is also a good general description of different photometers and photometrical methods. Owing to the large number of subjects included in the book it is impossible to develop any one of them very fully; nevertheless a fairly comprehensive theoretical and practical discussion is offered. The mathematics are elementary and the illustrations are simple and clear. The book will be useful to all students of electric lighting interested in German developments of the art and science.

Vorlesungen uber die Vektorenrechnung. By E. Jahnke. Leipzig: B. G. Teubner. 235 pages; 32 illustrations. Price, 5.6 marks.

Although this book deals almost exclusively with mathematics and just enough with physics to show that the mathematics is capable of practical application, yet it is not wholly without interest for electrical engineers. Probably no branch of mathematics is used more frequently by electrical engineers than that involving the vector representation of alternating quantities. It is this branch that the present volume covers. However, the treatment employed by the author is one that will appeal more strongly to the mathematical physicist than to the engineer. The first six chapters are devoted to vectors in a single plane, and the last 12 treat of vectors in space; the former are directly applicable to the ordinary single-frequency quantities, while the latter must be used when quantities of several frequencies are to be dealt with. It is customary either to neglect the vector-displacing effect of higher harmonics in alternating-current problems or to calculate the real effect without assigning a position in space to each vector, but for absolute accuracy certain of the vectors should be represented in the third dimension, certain in the fourth, etc. To those who wish to reach this higher degree of accuracy, the book will prove instructive and valuable.

The Jubilee of a Great German Electrical Company.

The largest German electrical manufacturing company, the Allgemeine Elektricitäts Gesellschaft, commonly called the "A. E. G.," celebrated on April 20 the fact that 25 years ago the company was founded. The history of the A. E. G. begins in 1881, when Mr. Emil Rathenau, visiting the Paris international exposition of that year, was highly impressed by the Edison incandescent system and decided to introduce it into Germany.

In 1883 the "Edison-Gesellschaft" was formed in Berlin with a capital of 5,000,000 marks. In the following year this company made a contract with the city of Berlin, and thus secured a franchise for 30 years for light and power throughout that city. A subsidiary company (the Berlin Electricity Works) was formed for this purpose, which to-day possesses several large power houses and a complete cable network with substations throughout Berlin. The electrical apparatus, cables and steam turbines have been and are still furnished by the "A. E. G." The old Edison-Gesellschaft found it necessary to increase its capital gradually to 100,000,000 marks (fully paid up), or including the reserves and bonds, about 180,000,000 marks.

In 1887 the name was changed to "A. E. G.," which translated means General Electric Company. The A. E. G. has at all times been closely identified with the progress in electrical engineering. Soon after the experiments at the exposition of Frankfurt on Main in 1891, which showed the possibilities of three-phase transmission, the company did pioneer work in this direction, and among other things built the hydraulic power station with transmission lines at Rheinfelden.

It was the "A. E. G." that first developed the Nernst lamp, which was a considerable step in advance. Of late the Nernst lamp has been more or less overshadowed by the metallic filament lamps, the manufacture of which has also been taken up by the A. E. G. In wireless telegraphy, the A. E. G., in combination with Siemens & Halske, has developed the "Telefunken" system. During the famous high-speed electric railroad trials at Zossen the experimental A. E. G. electric locomotive won the world's record, making a speed of 210.2 km per hour.

During the bad times of 1900 and the two or three following years, many German electric manufacturing companies suffered. Some of them failed altogether and others had to get out of their troubles by means of an alliance with a stronger company. The A. E. G. suffered least of all, and has always been able to pay handsome dividends to its stockholders. In 1902 the former Union-Elektricitäts-Gesellschaft became a part of the A. E. G., and in 1903 a community of interests was established between the General Electric Company of America and the Allgemeine Elektricitäts Gesellschaft.

The number of employes (not counting those outside of Germany, where the A. E. G. also owns several factories) is 30,700. The factories in Berlin occupy 272,800 square meters.

The value of the rough material necessary for manufacturing is 48.5 millions of marks per year. The cable factory alone used 19,700 tons of copper. No fewer than 43,900 dynamos, motors and transformers were manufactured in the machine factory, with an aggregate capacity of 854,500 kw. The amount of sales has increased from 1,213,000 marks in 1884 to 216,081,000 marks in 1907.

Outside of Berlin, 700 cities and towns in Germany and abroad have had their power houses built by the A. E. G. Their total capacity is 745,000 hp. The A. E. G. has built 4300 km (counting single track) of electric street railways, with 10,100 motor-cars and 20,500 motors. The turbine factory, which manufactures horizontal Curtis turbines, and which was opened four years ago, built turbines with an aggregate capacity of 560,000 hp. The sales organization comprises 45 offices in Germany, 85 independent companies and offices abroad, and 40 agencies outside of Europe.

Sandycroft Induction Motors.

Fig. 1 illustrates an improved type of induction motor known as the Hunt cascade motor and manufactured by the Sandycroft Foundry Company, of Chester, England. The motor resembles the ordinary induction motor in general appearance and is built in three different types, all for variable-speed work. The striking feature, in addition to its efficiency, is that, in its simplest form, although of the variable-speed class, it requires no slip rings on the rotor shaft, the control being effected through resistances connected to the stationary windings. The motor is provided with a short-circuited rotor winding without slip rings and has the same characteristics as an ordinary slip-ring motor. The starting or regulating rheostats are connected to tappings in the stator winding and the speed can be varied from creeping to full speed by adjusting the resistances. The starting torque is controlled in the same way, the motor, it is said, developing full-load torque when taking only full-load current. The motor combines the simplicity of the squirrel-cage motor with the good starting and speed regulation characteristics of the slip-ring machine, and it can be wound for very slow speeds, even in small sizes.

A modified type has the same stator arrangement, but the rotor has a double winding and is provided with three slip rings. The control is said to be as simple as that of an ordinary slip-ring motor, no changes of connections being necessary when varying speed. Where machines are required to run at two fixed speeds a short-circuiting switch is mounted on the side of the motor, which is connected to tappings in the stator windings. The motor is started by means of a resistance connected to the slip rings in the ordinary manner, and when it is desired to run at the lower speed, the slip rings are open-circuited and the tapping short-circuited. The machine then slows down to the second speed, acting as a generator while doing so. For such work as driving cranes, or where intermediate speeds are required, a special form of railway controller is supplied which controls both the stator and rotor resistances, but only one controlling handle is necessary. The motor is suitable for driving machines which require to be run efficiently for long periods at either one of two speeds. The efficiency is claimed to be high at both speeds, and the power factor but little reduced when running at the lower speed. The motor, the maker claims, will develop full-load torque when taking 0.7 times full-load current or will start against twice full-load torque taking 1.4 times full-load current. When taking a starting current equal to the full load it will develop about 1.45 times full-load torque.

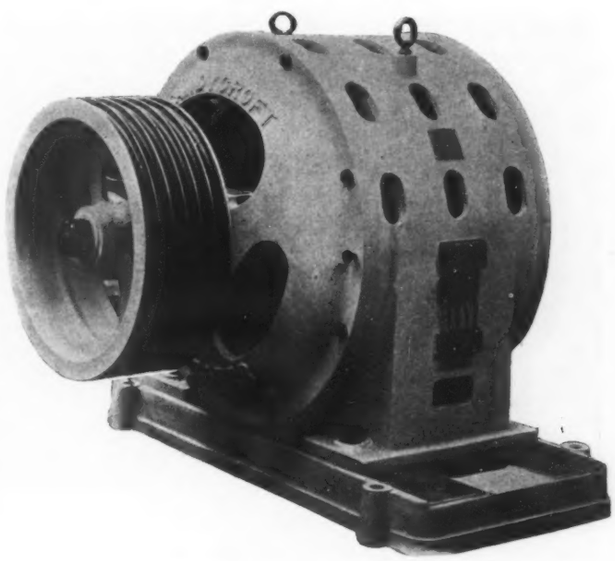


FIG. 1.—CASCADE MOTOR.

The losses at starting being small, the motor is well adapted

for driving machinery which has to be frequently started and stopped, or where a large starting torque has to be exerted. In the third arrangement, a change-over switch is provided in the stator circuit. This, it is claimed, enables the motor to run at three efficient speeds without rheostatic losses. Intermediate speeds are obtained in the same way as with the other machines. An advantage in these motors is the low speeds for which they can be built; for instance, a three-speed motor for driving an induced-draft fan wound for 50 cycles gives 25 brake horse-power at 720 r.p.m., with proportionately reduced outputs at 480 and 290 r.p.m., these speeds corresponding respectively to 8, 12 and 20 poles. Similar motors with 20 poles are made to give as low as 10 brake horse-power, and 12-pole machines 5 brake horse-power. In the two-speed machines the ratio is usually 2 to 3. The designs have been standardized from five to 200 brake horse-power at various speeds and for 50 and 25 cycles.

The "X" type of motor, shown in Fig. 2, is adapted for constant speeds. While possessing the good features of the ordinary squirrel-cage motor it is said to be simpler to handle, as no auto-transformer or suchlike starting device is necessary. The rotor is of the short-circuited type having high resistance squirrel-cage windings. The stator windings are of a patent type, giving alternative numbers of poles, and the motor is started by means of a simple automatic change-over switch

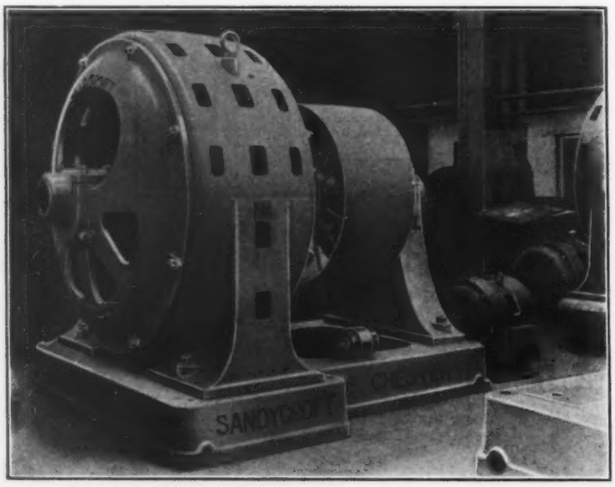


FIG. 2.—MOTOR.

which alters the connections of the stator windings from parallel star at starting to mesh for ordinary running. All that the operator has to do is to draw a spring bolt and move the switch into the starting position, where it is held by an electro-magnet energized by the stator current. As the motor speeds up the current in the stator falls until at normal speed the magnet releases the switch, which then drops by its own weight into the running position. The action of changing over can be regulated by springs and made to synchronize with normal speed so that no jump is caused in the circuit. For high-tension work the switches are of the oil-break type, and the hold on coil is wound for low tension and energized from the series transformer. The machines, the manufacturer claims, will develop twice full-load torque taking 3 to 3.6 times full-load current. With full-load current they will start against 55 to 60 per cent of full-load torque, and will develop full-load starting effort requiring 1.5 to 1.8 times full-load current, the actual value being dependent on the number of poles. The motors have high power factor when starting, so that difficulties with voltage regulation due to excessive lagging currents do not occur. The overlapping of the currents in the short-circuited rings and the fan action of the cross-connections with their consequent cooling effect allows the rings even of large motors to be of quite small cross-section. The inductance of the rotor is said to be less at starting than when running normally; this helps the power factor and increases the maximum-starting torque.

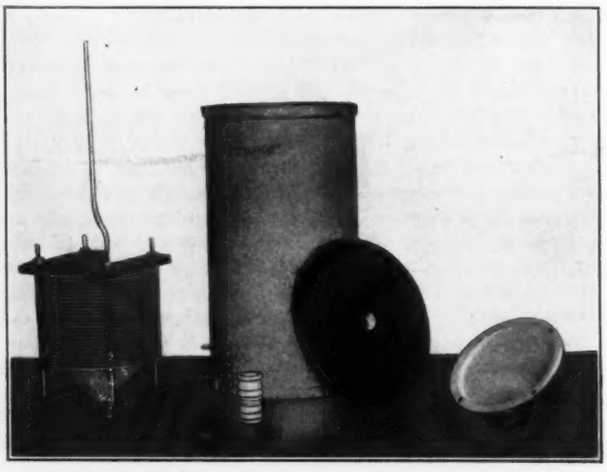
Aluminum Cell Lightning Arresters.

There has just been placed on the market by the General Electric Company a form of electrolytic lightning arrester known as the aluminum-cell arrester for operation on alternating-current circuits. The arrester, as shown in Fig. 1, consists essentially of a series of concentric inverted cones placed one above the other with a vertical spacing of about 3/16 in. The cones are insulated from each other except for the electrolyte, which partially fills them. Each cell then consists of two aluminum cones and the intervening electrolyte.

A sufficient number of cells placed in series form a complete arrester, the electrical characteristics of which are the same as a single cell. The cones complete with the electrolyte are immersed in a tank of oil which affords the necessary insulation and great heat absorbing capacity.

The efficacy of the cones as a lightning arrester depends upon a thin film which is formed upon the surface of the aluminum by a special process of manufacture. This film may be compared with the safety valve of a steam boiler which opens at a definite pressure and allows the steam to escape.

Each cell, two adjacent cones with intervening electrolyte, is designed to operate normally at 300 volts. If the potential rises to any value greater than 300 volts and less than 420 volts, the film allows the discharge to take place, but a thicker film is immediately formed and the current is again decreased



ONE LEG OF 12,500-VOLT LIGHTNING ARRESTER.

to a small value. When the line potential becomes normal this extra thickness of film gradually dissolves, leaving the film in its normal condition.

At 420 volts (about 40 per cent above normal voltage) the film opens and allows a free and heavy discharge to take place. This voltage represents the maximum critical film value per cell. The plate area of the cells is sufficient to allow a discharge of more than 1000 amperes at double normal potential, or 600 volts per cell. This represents a quantity of electricity many times greater than that usually liberated by an ordinary induced lightning stroke. Consequently it is not possible to get an excessive potential across the terminals by such discharges.

The aluminum-cell arrester is designed to be connected to the line through the adjustable horn-gaps. These gaps may be set so that the voltage will break across at any desired rise above the normal operating voltage. When the conditions warrant, the gaps can be set so as to allow the arrester to discharge when the line voltage rises only about 25 per cent.

The horn-gaps perform three important functions: First, they act as spark-gaps as explained; second, they may be used as disconnecting switches, and, third, for subjecting the arrester to normal voltage. It is recommended that current be sent through the arrester every day or two, so as to assure proper formation of the film on the aluminum cones. The horn-gaps are so constructed that they can be easily short-circuited momentarily for accomplishing their purposes.

The steel containing tank prevents liability of breaking during transportation, installation or operation. Another important feature in the mechanical construction of these arresters is that the aluminum cones are supported by their rims at four points, thus making a sturdy construction and eliminating any liability of the adjacent cones short-circuiting against each other. The cone shape, or pointed construction of the aluminum, has a very decided advantage in preventing explosive or corrosive action of the arrester and prevents local heating and short life.

Some of the advantages are as follows:

1st. They are designed to discharge at a comparatively small rise of voltage.

2d. The arrester will discharge the heaviest induced stroke without allowing an abnormal rise of voltage in the system.

3d. The large amount of oil used for heat absorbing and radiating capacity enables the arrester to discharge continuously for one-half hour. This is particularly desirable in case of a grounded phase, since the cause of the ground can often be located in a half hour's time, or the necessary switching done to transfer to another set of buses.

4th. An inherent feature of the aluminum-cell arresters with a properly formed film is the fact that no dynamic current will flow as a result of the discharge.

An Emergency Telephone Installation at Antwerp.

An emergency installation recently completed at Antwerp, Belgium, is of peculiar interest, on account of the ingenious adaptation of certain types of central-battery apparatus to other uses than those for which they were originally designed and the great saving of time thus accomplished in completely restoring a telephone service which had been entirely destroyed by a disastrous fire on the night of Oct. 28, 1907.

The fire started in a room adjoining the telephone exchange and before it was subdued completely wiped out the local exchange as well as the long-distance switchboard located in the same building. The local switchboard, a multiple-magneto board employing series jacks and manual restoring line and clearing-out drops, was the oldest multiple exchange in Europe. The subscribers' lines were all operated on grounded circuits, except 200 which operated on metallic circuits for subscribers talking long distance.

The morning after the fire a conference was held between the officials of the government, which controls the telephone system in Belgium, and the engineers of the Bell Telephone Manufacturing Company, the Antwerp house of the Western Electric Company, to arrange details for restoring the service. The first problem, after arranging to take care of the long-distance business over a temporary board, which work was completed in a few hours, was to restore telephone service to the subscribers in the shortest possible time. As a second consideration it was desired to make the installation of such a nature and design as to permit of an easy and economical transformation to a permanent and modern system. Several plans for a provisional magneto board were discussed, but upon the advice of the manufacturing engineers it was decided to use central-battery switchboard frames and to arrange all the circuits so that they would operate satisfactorily with the magneto subscriber sets which had been in use with the old board. This plan accomplished the saving of a great deal of time which would have been required to install new central-battery telephones at all substations and presented the advantage of using switchboard apparatus which could be readily rewired and used in any central-battery exchange.

The frameworks for 12 sections were immediately taken from the factory and set up in the new telephone building located about one mile from the old exchange. The standard central-battery line and cut-off relays were rewired to operate on the magneto calling system and the cord circuits were provided with series drops for clearing-out purposes. Such radical departures from central-battery principles involved a complete rearrangement of the circuits, and some auxiliary circuits, which had to be worked out as the installation progressed which it was impossible to try out until it was practically completed.

The new switchboard, as it now stands, consists of 12 subscriber sections, one auxiliary line section and one switching section, each section equipped with 4800 multiple jacks and 130 to 140 answering jacks and line lamps per operator. The main frame and relay rack are located in an adjoining room, but the intermediate distributing frame was left out of the emergency equipment in order to save time and avoid all unnecessary installation work. Twelve long-distance switchboards are located in line with the subscriber switchboards and a number of temporary tables have been arranged for regular chief operator and information-desk service. They are connected in the regular way by local trunks to the various switchboards to permit supervision and are arranged for central-battery transmission.

The entire switchboard installation was completed just 28 days after the fire. During this interval the subscribers' lines had been carried into the new terminal room, and each station had been called up and tested out from that point, so that it was possible, at this time, to begin immediately the work of connecting up the individual subscribers to the new board at the main distributing frame. Complete and regular service was restored on Sunday, Dec. 1, just 33 days after the fire. The Belgian Telegraph Administration had anticipated a delay of several months in opening the new exchange for service.

The Time-Element Thermal Cut-Out.

The time-element thermal cut-out illustrated herewith is actuated entirely by the heat generated in the circuit of the apparatus it is designed to protect. The device is very simple and consists of a chamber containing a resistor above which is placed a corrugated capsule, the expansion of which causes a piston pressing directly on to it to raise and actuate the trigger of the switch. The capsule can exert a pressure of 20 lb. to 30 lb. without being damaged. The burning out of a motor or other apparatus is caused not only by an excessive current, but also by the time this excess is allowed. This device, once set, acts quicker or slower according to the magnitude of the current

THERMAL CUT-OUT.

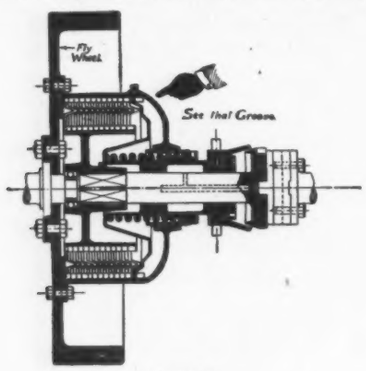
flowing, and with proper adjustment no apparatus thus protected should ever come to grief from this cause.

With normal current, the device absorbs only about five watts, and the heat developed in the chamber is radiated; but any overload above 10 per cent will cause the device to act in a time inversely proportional to the overload. Any motor or arc lamp takes at starting an increased current and especially so the alternating-current motors, and, in fact, there always is a rush of current on closing a circuit. The thermal cut-out not only allows the rush of current of starting, but also prevents this or any smaller excess above the normal to flow for an undue time. Further, an alarm can be given as soon as the piston begins to rise, and before the cut-out opens, thus giving sufficient warning to the attendant. The device is manufactured by the Simplex Conduits, Limited, of London, England.

The "Hele-Shaw" Clutch.

The accompanying illustration shows the "Hele-Shaw" clutch, an English invention, of which the Merchant & Evans Company, of Philadelphia, are the manufacturers in this country. It is stated that the English manufacturers have, during the past four years, installed something like 25,000 horse-power in rating of this clutch in over 50 different applications ranging from one to 1000 horse-power.

The peculiarity of the clutch lies in the fact that the engagement of the plates is in a 35-deg. V-shaped circumferential groove which, it is claimed, makes each pair of plates do three times the work of any flat pair, or the same work with one-third the spring pressure. By the engagement in a V-shaped groove, the flat portions of the plates, or the fins as they are called, are always separated by about ⅛ in. This permits the circulation of an oil bath constantly right up to the point of work and radiates heat continuously, thus preventing excessive temperature rise of the clutch due to slippage. In the event of the accidental absence of oil, the same amount of heat that would distort a flat plate does no injury to the Hele-Shaw plate because of its transverse rigidity due to its peculiar groove. The absence of heating makes it peculiarly advantageous for constant-duty work, such as planer and machine tool reverse gears, automobile and motor-boat work, all automobile drives, where the clutch is constantly working in and out of engagement, pulley and coupling work at important points, cranes, gas-



CLUTCH.

engine and electric-motor drives, rope-drive work for conveyors, hoists, etc.

Another peculiarity of the clutch is its uniform rate of pick-up. When thrown into an engagement it picks up its load on a straight diagrammatic line instead of a curved one. This peculiarly gratifying property of the Hele-Shaw clutch appeared in its experimental stage and was later proved in practice by its employment to couple up alternating (constant-speed) electric motors to Hoe printing presses. Unless the rate of pick-up in this engagement is absolutely uniform from a state of rest to full speed the damp paper in the press is torn. A number of large electrically-driven printing establishments in London are now equipped with Hele-Shaw clutches.

The inner disks of the clutch are of mild steel and the outer of phosphor-bronze except in certain peculiar cases, where all of the toothed plates are steel with intermediate slipper plates of bronze. The inner plates are toothed to the driven drum and the outer plates are toothed to the driving drum, and by proper mechanism the engagement is permanently or temporarily affected, as the design demands.

Equipment of English Mines and Factories.

Renewed activity appears to be manifested in the electrical equipment of English mines and factories. A number of new equipments are reported by the power and mining department of the British Thomson-Houston Company, as noted below:

Sheffield Coal Company, for its Birley Collieries, near Sheffield.—One 250-kw, 375 r.p.m., 3000-volt, 50-cycle, three-phase b.t.h. Belliss generating set; three-panel main switchboard; five sets of main and tail haulages (two 30 and three 50 horse-power); two motor-driven pumps (30 and 80 horse-power); one 100-kw and two 70-kw transformers, and high-tension and low-tension panels.

Pease & Partners, Darlington, for plant to be installed at Bowden Close Colliery.—One 120-hp, 480 r.p.m., 440-volt, 40-cycle, three-phase, slip-ring, protected type haulage motor, with tramway type reversing controller and panel; one 25-hp, 770 r.p.m. fan motor; one 130 kw, three-phase, 2750/440-volt, oil-cooled transformer, with the necessary switchgear.

Morris & Shaw, Ltd., Birch Coppice Colliery, Polesworth, near Tamworth.—Main switchboard, pit bottom and feeder panel; one 75-hp, three-phase motor for driving endless haulage gear; the requisite feeder cable.

Gwynnes, Ltd., Hammersmith.—Testing plant, consisting of a 120-kw motor generator set, made up of two 60-kw C. C. generators tandem coupled to one induction motor; one 110-k.v.a. three-phase motor generator, and a motor exciter of 10 kilowatts.

D. Selby Bigge & Company, for Earl Fitzwilliam's Colliery, Elsecar, near Sheffield.—One 350-kw exhaust steam turbo-alternator, with heat accumulator, condenser and the requisite switchgear.

Glenboig Union Fireclay Company, Glenboig, Scotland.—Two 45-hp, one 25-hp and one 15-hp, three-phase motors and panels and two transformers, for driving pumps at its works.

Finlayson, Bousfield & Co.'s linen-thread mills, Johnstone, Scotland.—One 200-kw, 428 r.p.m., 500/550-volt, 50 cycle, three-phase alternator, with three pedestal bearings, protection caps, rope pulley, base plate and direct-coupled exciter, together with the necessary switchgear.

Joshua Whiteley & Company, Ltd., Huddersfield, for their "Albert" textile mill.—Complete installation, consisting of 23 three-phase induction motors totaling upward of 800 horse-power, with the necessary steel work for mounting the ceiling motors and controlling gear and cables. This is the first textile mill to be electrically driven from the corporation three-phase mains in the Huddersfield district, which is one of the main centers of the textile industry. This contract should be as far-reaching in its influence on the development of textile driving in this district as the Acme Mill has been in Manchester.

D. Selby Bigge & Company, Newcastle-on-Tyne, for the Cannop Collieries, near Lydney, Glos.—Two 300-kw, 375 r.p.m., 2750/3000-volt, 50 cycle, three-phase alternators complete with exciters and rheostats, for direct coupling to high-speed engines.

Steel, Peech & Tozer, Ltd., Sheffield.—One 750-kw, 285 r.p.m. continuous-current generator for direct coupling to Belliss engine.

J. Booth & Bros., Rodley, near Leeds, equipments for four cranes.—Two 24, two 15, one 10, one 8, four 7½, one 5 and two 3-hp, three-phase, 400-volt induction motors, 710 r.p.m., in all 13 machines, complete with tramway-type controllers and brake magnets.

Admiralty.—Nine motor generators (eight 120 amp. and one 8 amp) for operating searchlights on H. M. S. *Defence.*

Robt. Addie & Sons Collieries, Ltd., for their Rosehall Colliery (No. 7 pit), Coatbridge.—One 250-kw (310 k.v.a.), three-phase generator, 550-volt, 50-cycle coupled direct to Belliss engine.

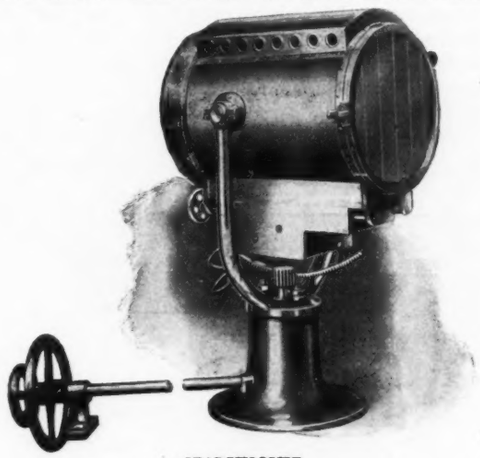
Messrs. Stevenson, McGuffie & Milne, of Glasgow, for Binley Colliery, belonging to Messrs. Merry & Cunninghame, Glasgow.—Two 62½-kw C. C. generators coupled on combined base to one Howden engine; one four-panel switchboard.

The Ansley Hall Coal & Iron Company, Atherstone, Warwickshire.—One 500-kw, 340 r.p.m., 500-volt, compound wound, open type C. C. generator, to be driven by ropes by a pair of Robey engines running at 85 r.p.m.; two switch panels for above.

The Dean & Chapter coke oven plant of Messrs. Bolckow, Vaughan & Company.—Eight 16-hp, two 10-hp and four 3½-hp, three-phase motors complete with the needful controllers and switches.

Marine Searchlight.

The accompanying illustration shows one of many different types of searchlights manufactured by the Carlisle & Finch Company, of Cincinnati, and which is said to embody all the latest improvements. This type of searchlight is intended to be placed on the upper deck or mast of the vessel and to be operated from the bridge or some other distant point. The horizontal controlling rods may be made any length desired and are supported in small brass bearings. All parts of the lamp are made of brass and copper and are not liable to corrosion. The mirrors used in this and in all of the searchlights



SEARCHLIGHT.

made by the company are carefully ground and polished and silvered on the convex side. The company manufactures searchlights up to and including projectors of 38 in. in diameter and in a great many different styles to meet various requirements. A 9-in. yacht searchlight, arranged for pilot-house control, is fitted with a new form of carbon-feeding mechanism. This follows the same general construction of the mechanism of larger lamps with the exception that it is more compact. The lamp is arranged for both automatic and hand control and is suitable for launches and yachts. The company also builds a 14-in. marine-type projector which is fitted with a glass lens mirror, the metal parts being made of brass and copper so as to withstand the corroding action of the salt air.

The Cutting of Armature Disks and Segment Blanks.

The extensive introduction of electric motors and dynamos for power and lighting purposes has created a large and increasing demand for special tools and machinery for the accurate and economical production of the various parts entering into their construction. One of the most important of these parts is the armature disk. The needs of the trade demand many different sizes of armatures, which has consequently developed several distinct methods for making the blanks or punchings from which the armatures are built up.

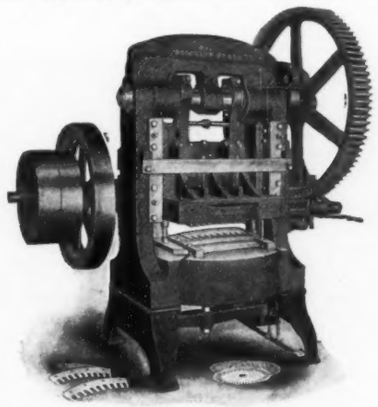


FIG. 1.—ARMATURE DISK AND SEGMENT CUTTING PRESS.

The usual form of armature is made up of annular disks with notches on the outside and inside edges. As it is essential to have the outside and inside concentric it has been found best to adopt dies which, by cutting them simultaneously, eliminate the inaccuracies which are almost unavoidable when the cutting is done in two or more operations. In many cases the notches and keyslots are also punched at the same time, all of which call for tools having "throw-out" pads in addition to the cutting parts, so as automatically to push the disks and scrap out of the dies and punches.

These "throw-out" pads have generally been operated by means of heavy springs, which are not always reliable and consume a great deal of the power of the press. To overcome the uncertainty of positively stripping the blank and the use of

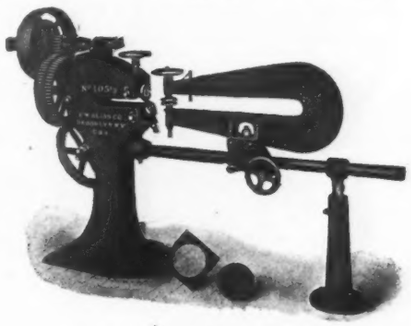
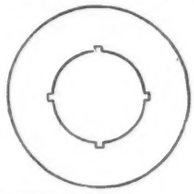


FIG. 2.—CIRCLE SHEAR.

unnecessary power, the press shown in Fig. 1 has been so designed as to do away with springs and to operate these "throw-outs" in a positive manner, and in doing so to consume but little of the power of the press.

The bottom plate, which operates the "die-pads" through radial slots or pin holes in the bolster, is actuated by two rods



FIGS. 3 AND 4.—ARMATURE DISKS.

connecting it directly with the slide, as shown in press illustrated in Fig. 1. It is adapted for both disk and segment cutting.

When presses are to be used exclusively on work requiring "die throw-out" pads some manufacturers prefer a solid bed

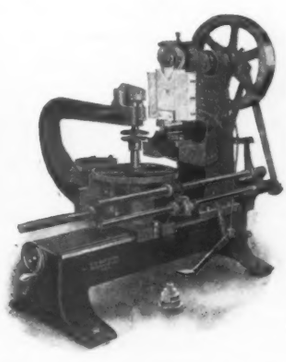


FIG. 5.—ARMATURE DISK NOTCHING PRESS.

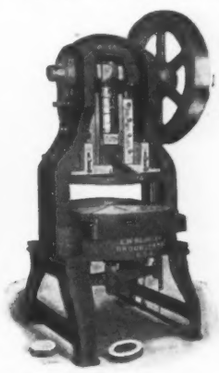


FIG. 6.—ARMATURE DISK CUTTING PRESS.

with radial pin slots and "T" bolts, as shown in Fig. 1, but the presses are more generally built with bolster plates.

For disk cutting only, two cross-pieces adjustably attached to the frame of the press actuate the "throw-out" pads of the

punches by striking against them on the return motion of the slide. For cutting armature segments, as well as disks, a plate knockout in the slide, as shown on press in Fig. 1, is required instead of the bar knockout, which permits of locating knockout pins at any point in the slide as may be required by the size and shape of segments to be cut.

According to the size and quantity of disks required they are usually cut in one of many ways. For very large diameters or relatively small quantities, the shearing of the outside and inside circles is done on a circle shear, such as shown in Fig. 2. These disks are then notched on a notching machine, such as illustrated in Fig. 5. The key notches on the inside are usually slotted by means of a vertical shaping machine after the disks have been put together. A deep-throat press fitted with a special attachment may also be used for this work.

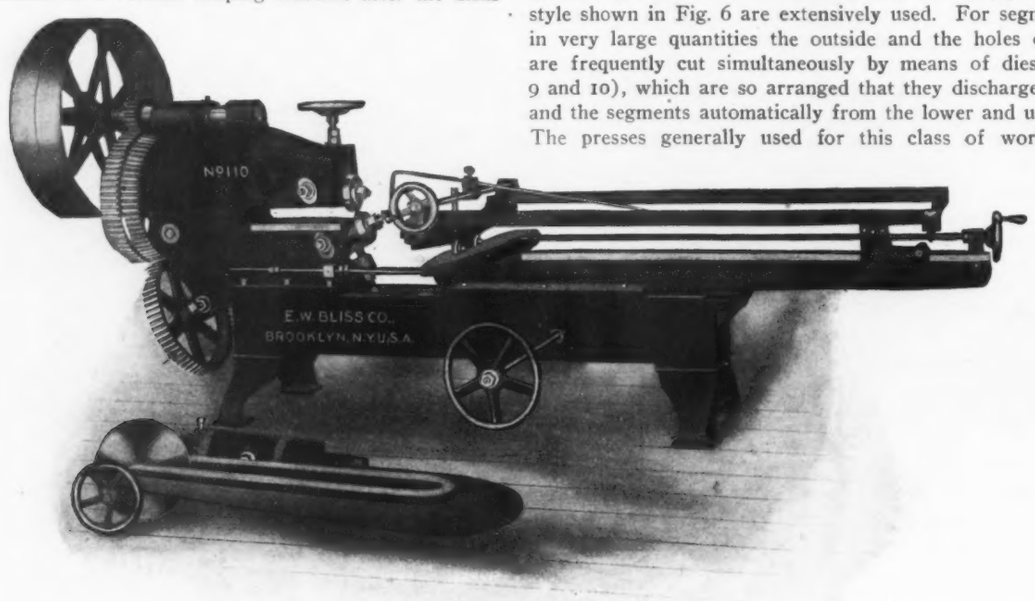


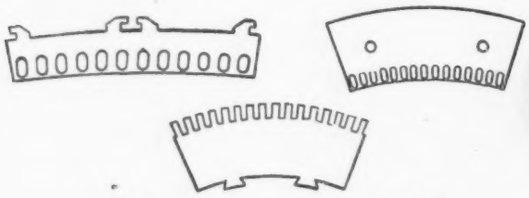
FIG. 7.—CIRCLE SHEAR, WITH SEGMENT-CUTTING ATTACHMENT.

For such disks as are made in large quantities and which are of moderate diameter (street-car motor disks, for instance), the best factories use power presses with tools so arranged that the inside with its key slots and the outside with its notches are cut simultaneously at one stroke (see Fig. 3). This constitutes the quickest, most accurate and most economical way of manufacturing armature disks in large quantities. The presses used for these dies are provided with knockout attachments which discharge the scrap and the disks so as to lie loosely on top of the dies whence they may be easily and quickly removed. When possible the presses are placed in an inclined position, allowing the blank to fall off by gravity, which method permits of increasing the daily production.

In many cases where the dies, mentioned in connection with the second method, would be too costly to be used economically, a successful method for good results is the cutting out simultaneously of the plain outside and the notched inside as indicated by Fig. 4. This method produces an absolutely concentric blank ready to be notched, and, as the outside notches are cut separately, the power of the press is equal to cutting much larger diameters than when the outside, inside and notches are cut simultaneously as specified in connection with the second method. The notching is then done on a notching press, such as illustrated in Fig. 5. From the inside scrap the projections corresponding to the key notches are usually removed by a die which at the same stroke cuts the inside with its key notches, thus working the scrap over into smaller disks without any loss of stock.

In some works it would not pay to use the dies named for the third method, which dies are still somewhat expensive on any but the most current sizes of disks. In that case dies which cut the outside and inside separately are used and operated in standard presses. For the smallest sizes of disks, presses of the style shown in Fig. 6 are extensively used. For segments used in very large quantities the outside and the holes or notches are frequently cut simultaneously by means of dies (Figs. 8, 9 and 10), which are so arranged that they discharge the scrap and the segments automatically from the lower and upper tools. The presses generally used for this class of work are the double-crank type, such a press being illustrated in Fig. 1, the size depending upon the length of segment. However, many segments have their plain outside cut first and are perforated or notched separately in a notching machine, such as illustrated in Fig. 5, to which is fitted a segment-notching device.

In some cases segments are of such a large size and the number required comparatively small; in these cases it has been found economical to adopt the following method: To cut the inside and outside diameters in a circle shear fitted with segment-cutting device, such a machine being illustrated in Fig. 7, after which the ends are sheared in a power squaring shear by means of a stop gage. The notches are then cut in an armature-notching machine, such as illustrated in Fig. 5, which for this purpose is fitted with a segment-notching attachment, not shown in the machine illustrated. In Fig. 11 is shown an armature-disk cutting die and punch, such as used for cutting the inside, outside, notches and keyways simultaneously. This construction of die has been found to give very good results. The machines illustrated are built by the F. W. Bliss Company, Brooklyn, N. Y.



FIGS. 8, 9 AND 10.—ARMATURE SEGMENTS.

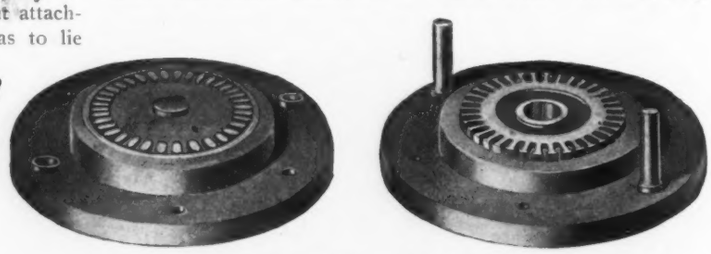


FIG. 11.—ARMATURE DISK-CUTTING DIE.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Unseasonable weather conditions during the last week curtailed distributive trade, but sentiment was greatly improved in financial circles by the successful bond flotations. Fall orders are scarce and collections remain slow. In most industrial lines curtailment is still the feature. The number of idle freight cars has reached a record low point, but money continues abundant and easy, with little demand. Foreign trade, as a whole, was quiet with a promise of improvement in export demand for cereals after the smallest week's shipments in two years. Prices are irregular. Certain iron and steel lines show improvement, but as a whole that line of trade is quieter than a week ago, the pig-iron industry being exceptionally dull. Good crop conditions promise well for all lines of business, but at present reports indicate a small volume of trade. Business failures for the week ended April 30, as reported by *Bradstreet's*, were 282, against 254 last week, 163 in the corresponding week in 1907, 139 in 1906, 193 in 1905 and 176 in 1904. The electrical export trade during the last month on the whole has held up remarkably well considering financial conditions in this country, which were more or less reflected in all other countries. The falling off in this branch has been estimated at about 15 per cent from the same period a year ago. There are many indications that a number of large electrical development projects which were stopped at the time of the panic will shortly be taken up again and pushed to conclusion. The total gross earnings of 194 electric traction properties in 1907 was $235,718,432, an increase of $23,275,526, or 10.9 per cent over 1906, but the first quarter for 1908 will undoubtedly show a heavy falling off from the above figures. The circular issued by Mr. George Westinghouse to the Westinghouse stockholders urging them to subscribe to the new "assenting" stock, which will enable the company to emerge from the receivership, attracted much attention and the consensus of opinion was that the stockholders would advance the necessary funds, especially in view of the fact that the business of the Westinghouse Electric Company is in good shape and showing betterment from month to month.

STATUS OF EXPORT TRADE.—According to an officer of one of the largest electrical exporting houses which has offices in nearly all of the civilized countries, there is every indication that during the next decade China will take place as one of the largest, if not the most important, importer of American electrical machinery. "Japan for some time has been an important factor," he said, "and at present is the most active foreign country in electric development, but China is beginning to stir and seems to offer the most possibilities for the future. The opportunities in a country with 400,000,000 inhabitants, which has been practically at a standstill for centuries, is obvious and already there are indications that the rooted customs of the country which have been so long an obstacle against the introduction of modern methods, are beginning to change. In the past the Chinese would touch little in the line of cereals except rice, but now they are beginning to take up wheat and grain, and recently machinery for flour mills has been shipped up the Yang-tse-Kiang, where there is good hydraulic power. Although there is much coal in the kingdom, it is mined in a primitive fashion and a great deal is brought from the Pacific islands. With its immense population and its many opportunities for excellent hydro-electric installations, China should develop enormously. The trouble with the Chinese is that they have very little engineering ability. They have not sent their young men to the American universities to learn modern engineering methods as have the Japanese, and heretofore most of their importing has been done through English or Japanese concerns. The Chinese business man is a wonderfully close buyer, but is as honest in his dealings as one could wish. This is in accordance with the reverence which he feels for his ancestors which permits him to do no dishonest act. In contrast are the Japanese, who may be charitably described as 'shifty.' That the Japanese realize the superior ethical qualities of the Chinaman is shown by the fact that a large percentage of the clerks in the Japanese banks are Chinamen. The opening up of China has been largely done by the Japanese, but at present there exists a trade boycott between the two countries which grew from the seizure by the Chinese of a Japanese vessel laden with munitions of war, and was intensified by the failure of a large Japanese bank which had Chinese connections. Bank failures in China are almost unknown. Most of the Chinese importing has been done through the house of Mitsui & Company, headed by Prince Mitsui, who is called the 'J. Pierrepont Morgan of Japan.' As yet the trade boycott has not made itself felt in this country and whether or not it means that hereafter Chinese buying will be done directly, or simply placed through another house, remains to be seen. American machinery holds the field in China and Japan, although the English and Germans are by no means negligible quantities. The predominance of the Americans is due to the fact that the Japanese control the situation in both countries and the Japanese, educated along American lines and familiar with American products, stick to the methods and products with which they are acquainted. South Africa, Australia and India continue, as in the past, to purchase the major part of their electrical supplies in England. In the Philippines there is little activity in electrical lines excepting government supplies. In Panama there is an active government demand, but the manufacturer does not get his money for 12 months or longer and so vexatious is the system of inspection and there is so much bureaucracy and so many men 'higher up,' that practically all of the large concerns have ceased bidding on government material. The building of the canal by the army is a huge blunder. There are four clerks to every workman and more time is spent in estimating the height to which a laborer swings his shovel and seeing that he does not work five minutes overtime, than to the actual amount of work he accomplishes. In many instances civilians are at the head of departments which should be run by engineers. If the building of the canal had been sub-let to hard-headed Irish contractors there would have been an immense saving in time and also of about $15,000,000 in cash. Cuba is purchasing little on account of bad sugar and tobacco crops and the same is the case with Porto Rico. Conditions in Cuba have improved vastly since we again took over the island and it is to be hoped that we remain in control. The country offers excellent opportunities and is at length getting down to a strong, stable business basis. In Brazil and Peru the Germans have practically run away with the market owing to close price-shaving and strong home co-operation and backing. The German Emperor is more of a Commercial Emperor than a War Emperor. He has made a strong bid for foreign business by awarding medals, subsidies and by backing exporters with all the other means in his power. Notwithstanding the fact that German freight rates to Valparaiso, Iquique and Lima are $2 per ton higher than American freight costs, the Germans have all but shouldered the English and Americans out of the market. The Deutsche Bank has branches in Mexico, Brazil, Argentina and Peru; the local branch looks into an account and if satisfactory, guarantees it to the manufacturer, often allowing a year's credit. Moreover, the Germans have a system of pooling business interests, a sort of 'close corporation' among themselves. If the steel salesman comes across anything of interest to the electrical representative, he transmits the information and vice versa. There are indications, however, that the tide is about to turn from the Germans toward the Americans and English. If a German agent sells a 100-hp motor the native purchaser gets exactly 100 horse-power and no more to allow for overload. The leeway in our machinery is giving it a better standing than the German output. Chili and Peru are virtually bankrupt and very few orders are being placed. Their condition might be called an echo of the crash here. Their currency has depreciated heavily, inflation and excessive and 'wild-cat' mining speculation having contributed to their financial prostration. Strangely enough Argentina, on the other side of the Andes, is in splendid financial and industrial condition. The country

is rolling in wealth, the cattle herds were never larger and the country will produce more wheat this year, it is predicted, than the United States. Never in its history was the Argentine Republic in better shape. Nearly all of the large electrical houses have branches in Canada, as the duty prohibits much exporting. Mexico continues to furnish an active demand for American products. Summarizing the general export situation, it is evident that, under the financial conditions, the export business is holding up remarkably well, vastly better than home electrical markets. As compared with the same time a year ago the export trade has fallen off by between 15 and 20 per cent, which, all things considered, is an excellent showing."

WESTINGHOUSE COMPANIES.—The business of the Westinghouse compauies for the month of April continues to show the evidences of improvement which have manifested themselves since the beginning of the year, when the first signs of a returning activity in the industrials became noticeable. As far as the affairs of the Westinghouse Electric & Mfg. Co. are concerned, the improvement was not marked by any spurts in the shape of very large orders. On the contrary, the increase has been slow and steady and was especially remarked in those departments where the smaller apparatus is constructed. "Our business in small motors," remarked one of the heads of the department, "has never been better than at present." Similar information was obtained from the industrial and power department. A particularly encouraging feature in the operations of that branch has been the business in electric mining machinery, especially mining locomotives, for which the company has received quite a large number of contracts this spring. The export business of the Electric Company has also been unusually active within the last three months. The fact that the Westinghouse Machine Company was taken out of the hands of the receivers on April 1 had undoubtedly a favorable effect upon the affairs of that company, inasmuch as the business during last month showed strong and encouraging signs of a distinctively active revival. Various orders for large steam turbines were obtained at the East Pittsburg works, and the producer, gas engine, steam engine, as well as the stoker departments show this increase in business. Among the turbine orders was one for a 5000-hp machine from the West Penn Railway Company, of Connellsville, Pa., making the fifth turbine of the Westinghouse type ordered by that company within the last three years. The City of Cleveland also furnished a repeat order for a 2000-hp steam turbine, to be installed in the municipal lighting plant. A 1000-hp turbine order was also received by the Machine Company from the Hawaiian Electric Company, of Honolulu, and an order for a 5000-hp turbine came from the New England district, the Hartford Electric Company sending the contract. The business at the works of the Air Brake Company in Wilmerding, and in the shops of the Union Switch & Signal Company in Swissvale has not made any records of exceptional improvement. The operation of these plants depends almost entirely upon the activity in the railroad business, and no great revival is looked for by these companies until the railroads are again in a position to take up new construction work, as well as new brake and signal equipments.

WESTINGHOUSE EXPORTS.—It is gratifying to note the continued demand from the Far East for American machinery. Japanese industries are particularly active in this direction and within a recent period the Westinghouse Machine Company has booked a large number of orders through its Japanese representatives, Messrs. Takata & Company, of New York and Tokio. Outside of turbines and gas engines, the demand for vertical compound steam engines, a characteristic of Westinghouse construction, is as active as ever. Three 500-kw Westinghouse turbines have been shipped to the Imperial Steel Works, Japan, and to the Hakkaido Tanko Steamship Company. The Noble School, Japan, has installed a gas engine producer plant. Four 105-hp compound engines go to the Tamagawa Electric Company, Japan, and to a private isolated plant in China. Other equipments have been ordered by the Acadia Sugar Refining Company and the Yamada Hospital.

MOTOR MACHINERY FOR VITICULTURE.—Considerable attention is being attracted in Europe, a consul writes, by the application of motors for agricultural purposes, and especially for viticulture. The international competition for motor machinery will be held at Palermo, Italy, in the fall and a royal decree states that the machine adjudged to be the best will be awarded a diploma and about $2,000, and that the Minister of Agriculture will purchase two of this class. The second prize consists of a medal and about $600. Application for admission must be sent to the Minister of Agriculture at Rome, not later than Aug. 15, and the machines or apparatus must reach Palermo by Oct. 16.

REPRESENTATION FOR AMERICAN FIRMS IN EUROPE.—A member of a New York firm of engineers who will leave this country shortly for an extended business trip in Europe, would like to hear from American firms who desire to obtain a market for their goods in any of the European countries. He says that he has business connections in Austria, France, Germany, Italy and Switzerland, all of which countries it is his intention to visit. He adds that he is familiar with European market conditions and possesses a knowledge of the languages required to do business. His name and address may be obtained from the Bureau of Manufactures, Washington, D. C.

NEW WIRELESS INSTALLATION.—A complete equipment for a 20-kw wireless station was shipped on April 25 to the Dominican Republic on the island of Hayti by the firm of Frame & Company, of 90 Wall Street. This new government station will have an effective range of 800 to 1000 miles and will communicate with Central America, North America and South America. A 2-kw service has been shipped to the new revenue cutter *Androscoggin,* which is stationed at Baltimore. The *Androscoggin,* with a displacement of 1276 tons, is the second largest vessel of her class in the service, and is the tenth of the U. S. revenue cutters to be equipped with the wireless service.

DEVELOPMENT OF WHITE RIVER.—The hydro-electric power development on the White River will be completed this year. Plans and specifications are being prepared by Mr. H. von Schon, consulting engineer, Wayne County Bank Building, Detroit, Mich. The works required will consist of a spillway 300 ft. long and 20 ft. high; reservoir banks 15 ft. high and 250 ft. long, and a system of waste gates. The power station was built some years ago. The power equipment will provide for an output of 600 kw. The electrical energy is to be transmitted to Noblesville, two miles distant from the power site.

BRITISH THOMSON-HOUSTON COMPANY, Rugby, England, has sold to the Vickers Sons & Maxim, Ltd., Barrow-in-Furness, on behalf of the Admiralty, 21 motor-generator sets, each giving 120 amp at 55 volts (6.6 kw), 1600 r.p.m., with the necessary control panels. These are to operate searchlights on board H. M. S. *Vanguard,* a battleship of the *St. Vincent* class which Vickers are building. The company has also sold to the Admiralty nine motor-generator sets, eight of 120 amp and one of 80 amp, for operating searchlights on H. M. S. *Defence.*

WINNING FOREIGN MARKETS.—Many letters having been received by the Bureau of Manufactures from American exporters making inquiry as to the best methods to pursue in seeking foreign trade, a monograph of 256 pages has been prepared covering various phases of this subject. It is entitled "Winning Foreign Markets," and contains chapters on Methods and Requirements, Obstacles to Trade, Shipping Facilities, Proper Packing, the Parcel Post, Foreign Advertising and Patents and Trade Marks. Copies of the book may be secured on application to the Bureau, Washington, D. C.

TRADE WITH GERMANY.—The statistics of the trade of the United States with Germany for the nine months ending with March, show that the exports of electrical instruments and appliances was $174,583, as compared with $275,198. The exports of heavy electrical machinery were $59,445 as compared with $74,335. Other instruments for scientific purposes were $226,646, as compared with $168,214, showing a gain instead of a decline as in the two other instances.

ELECTRIC AUTOMOBILES.—The Washington commercial representative of a foreign government advises the U. S. Bureau of Manufactures, Washington, that a firm in his country would like to obtain the agency of an American electrical automobile manufacturer for the sale of his goods.

OPENING FOR SALE OF ELECTRIC AUTOMOBILES. The commercial representative in Washington for a foreign government advises the Bureau of Manufactures that a firm in his country wishes to obtain the agency for the automobiles of an American electric automobile manufacturer.

STATUS OF THE COPPER MARKET.—Copper prices remained substantially unchanged throughout the week, but the continued lack of home consumption, the coming increased production, and the pressure to sell in London caused by the presence of Japanese and Chinese metal and heavy American imports, gave a decidedly weak tone to the market. The improvement in demand expected for this month has not materialized, and 12-cent copper in June seems the logical outcome of the situation as it exists at present. The good buying movement which started in March has almost entirely disappeared. Consumers realize that the metal is cheap at present prices, but notwithstanding easy money are not buying ahead, and probably will not buy for future until there are actual orders on hand covering such purchases. Continued heavy exports during April enabled the market to remain steady, and as there is a large amount of copper going into consumption abroad, it is likely that Europe's capacity for American metal at present prices is still a considerable way from being exhausted. For the month of April, shipments showed an increase of 10,133 tons, or nearly 50 per cent over March, and an increase over last year of 14,490 tons. Since Jan. 1 exports have been 110,957 tons, as compared with only 57,532 tons for the first four months of 1907, an increase of 53,425 tons. Following are the figures for exports during the last four years:

	1907-8. Tons.	1906-7. Tons.	1905-6. Tons.	1904-5. Tons.
April	31,753	17,263	16,330	24,121
March	21,620	13,006	16,433	21,073
February	24,650	9,174	15,801	17,508
January	32,944	17,089	15,307	21,245
December	37,034	13,992	18,158	19,847
November	33,787	18,451	13,195	22,294
October	28,786	17,528	17,784	26,585
September	17,157	14,119	19,755	20,569
August	13,208	20,682	22,692	24,906
July	14,646	18,309	18,478	19,490
June	16,193	18,634	22,096	16,279
May	9,010	19,260	23,758	14,772

Monday's market showed little change except with a more developed weaker tone, arising from continued pressure to sell abroad. Closing prices were as follows:

Lake	12⅝ @ 12⅞c.
Electrolytic	12½ @ 12¾c.
Castings	12¼ @ 12½c.

The London market was as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	56 17 6	57 0 0
Standard copper, futures	57 10 0	57 12 6
Market	Steady.	Firm.
Sales of spot	250 tons.	
Sales of futures	400 tons.	

Extreme fluctuations for the year:

	Highest.	Lowest.
Electrolytic copper, spot	13¾	12¼
Lake copper, spot	13⅞	12⅜
Castings copper, spot	13½	12⅛
London copper, spot	£64 5 0	£56 10 0
London, futures	64 10 0	56 17 0
London, best selected	67 10 0	60 15 0

BRAZILIAN NORTHWEST RAILWAY.—The importance of the Brazilian railroad, known as the "Noroeste" road, work on which was started two years ago by a French company, under the present plans promises to outrank any railway enterprise undertaken in South America in recent years. This railroad will cross the Parana River within a few miles of the junction of that river and the river Tiete. Each of these rivers at that point has a magnitude nearly equal to the Mississippi at any point above its confluence with the Missouri. Within a few miles from the point on the streams where the railway will cross each of the rivers is broken by waterfalls with a head of 45 ft. and having a volume of water, according to the chief of the Brazilian Zoölogical Service, rivaling that of Niagara Falls and capable of furnishing power to the extent of millions of kilowatts. This location offers opportunities for twin cities on the South American continent which may be destined to outrank the great industrial centers at the head of navigation on the Mississippi. The initial station of the railroad mentioned is at Bauru, the present terminus of the northwest branch of the Sorocabana Railway in the state of Sao Paulo. From these the line extends northwestward. There are now 110 miles in operation over a territory which two years ago was virgin and scarcely well explored. Surveys have been completed to the point to where the road is to cross the Parana River, which forms the boundary line between the state of Sao Paulo and the state of Matto Grasso. It was intended originally to extend the line from the Parana River to Cuyaba, a point nearer the geographical center of Matto Grosso, but this plan has been modified in view of the evidently superior position of a terminus on the Bolivian border and on the great stream forming the boundary line between the two countries. With the prevailing high prices for coal it is not likely that the splendid opportunities for water power will be neglected, both in reference to the railroad and to light and power for the adjacent districts, which the falls are more than ample to supply.

WIRELESS FOR VENEZUELA.—As a result of the disagreements between the French Cable Company in Venezuela and President Castro it is stated that President Castro has taken steps to install five wireless stations at different towns to supplant the cable company. E. C. Newton, a representative of the De Forest Wireless Company, left Porto Rico several days ago to arrange with the President for the installations. Concessions were given to the French company in 1887, but in recent years the operation of the concessions has been attended with many difficulties, which finally ended in open rupture between the government and the cable company. The latter placed its affairs in the hands of the French government, which gave assurance that it would protect the company against any arbitrary action. In 1900 the contract between the government and the cable company had been modified in accordance with the views of the cable company, and for which the company paid a large sum to President Castro and his ministers. In 1902 President Castro again made charges against the company, and friction has existed since that time.

THERMIT IN CANADA.—The Goldschmidt Thermit Company announces the establishment of an office and works at 103 Richmond Street, W., Toronto, Can. The new branch was opened for business on May 1, and is under the management of Mr. E. C. Rutherford, of Toronto. Mr. Rutherford is a Canadian by birth, and has a wide acquaintance among the business men of the Dominion, having been for several years the manager of the Magann Air Brake Company, and of the Canadian Brake & Supply Company. A complete stock of thermit and appliances will at all times be carried at Toronto, and the branch organization will be in a position to execute promptly the welding of heavy steel sections, such as sternposts of steamships, crank shafts, etc., as well as trolley rails in paved streets, motor cases, and other broken steel sections. A fully equipped repair shop will be in operation for the repair of steel castings up to 1000 lb. in weight.

Financial Intelligence.

THE WEEK IN WALL STREET.—Up to the beginning of last week, the steady advance in the securities market was a reflection of the gradual improvement in business conditions, and was based on the feeling that the business depression had reached its lowest level, and that the tide had set in slowly but strongly in the other direction. Two large Wall Street firms which

NEW YORK

	Apr. 27	May 4	Shares Sold.		Apr. 27	May 4	Shares Sold.
All-Ch.	8	8¼	2,400	Int-Met., com.	10½	9⅞	14,400
All-Ch., pfd.	20⅞	20⅝	4,237	Int.-Met., pfd.	28¼	27½	10,000
Amal. Cop.	60⅛	60⅜	203,875	Mackay Cos.	61½	61½	910
Am. D. T.	39*	39*	——	MackayCos.,pfd.	65½	65⅜*	657
Am. Loc.	47	47⅝	14,965	Met. St. Ry.	20	25*	300
Am. Loc., Pfd.	100	99½	1,410	N.Y. & N.J. Tel.	100*	108*	233
Am. Tel. & C'bl.	50*	50*	——	Steel, com.	35⅞	35⅜	365,189
Am. T. & T.	118¾	117½	2,210	Steel, pfd.	100⅜	100¾	39,372
B. R. T.	47½	46⅛	52,395	W. U. T.	51½	50¾	2,030
Gen. Elec.	134	133	1,600	West'h, com.	56	48	13,050
Hud. R. Tel.	—	—	——	West'h, pfd.	68*	64*	725

PHILADELPHIA

	Apr. 27	May 4	Shares Sold.		Apr. 27	May 4	Shares Sold.
Am. Rys.	44¾	44⅜	——	Phila. Elec.	7 15/16	8⅛	——
Elec. Co. of Am.	9½	9⅞	——	Phila. R. T.	18⅛	18	——
Elec. Stor. B'ty.	30	29	——	Phila. Traction.	—	89	——
E. S. B'ty, pfd.	—	—	——				

CHICAGO

	Apr. 27	May 4	Shares Sold.		Apr. 27	May 4	Shares Sold.
Chicago City Ry.	160	160	——	Met. Elec., com.	17	17	——
Com. Edison.	92	91½	——	Met. Elec., pfd.	47	46	——
Chicago Subw'y.	18½	—	——	National Carbon.	57¾	57½	——
Chicago Tel. Co.	118¼	118	——	Nat. Carbon pfd.	109¼	110	——

BOSTON.

	Apr. 27	May 4	Shares Sold.		Apr. 27	May 4	Shares Sold.
Am. Tel. & Tel.	119	117¼	——	Mass E. R., pfd.	46½	44	——
Comb'ind Tel.	109	—	——	Mex, Tel., pfd.	—	5⅝	——
Edison El. Ill.	213	—	——	New Eng. Tel'p.	114	113½	——
Gen. Elec.	134½	134	——	W'st Tel. & Tel.	6	—	——
Mass. Elec. Ry.	9½	10	——	W. T. & T., pfd.	66½	65	——

*Last price quoted

Shares sold are for week April 27 to May 2.

held other views were caught in the rising market and forced to cover, precipitating a "bear panic" which drove the market sharply upward. In addition, the market was influenced by a number of favorable factors, such as the phenomenal success of the Pennsylvania loan, the ease of money, and the indifference of the loan market to the Treasury's call for $45,000,000 and engagements for $4,000,000 of gold for shipment abroad. The poor Steel statement was discounted by the Street. As the week progressed the buying by shorts began to exhaust itself and there was a tendency on the part of operators to realize. Following the circular issued by the president of the Westinghouse Electric & Manufacturing Company urging the stockholders to subscribe to a new stock issue, the Westinghouse securities fell sharply, recovered somewhat, and fell again on Monday. The rumor that the reorganization plan was in danger of failing was emphatically denied by officers of the company. Upon heavy liquidation in London and profit taking here, stocks on Monday eased off, in some cases closing below Saturday's levels, but the general tone of the market was one of strength. Monday's closing prices are given in the table on page 997.

MERCHANDISE CREDITOR'S PLAN PROGRESSING.—The meeting of the stockholders of the Westinghouse Electric & Manufacturing Company, which was scheduled to take place at East Pittsburg on April 29 to consider the advisability of issuing bonds in accordance with the plans of the Readjustment Committee, was adjourned in view of the progress in the plan submitted by the Merchandise Creditors' Committee, which provides for an issue of $10,000,000 of assenting stock without an issue of bonds. Of this stock the Merchandise Creditors' Committee, representing the large creditors of the company, proposes to accept for their claims $4,000,000 of the new stock and of the remaining $6,000,000 the creditors of the Security Investment Company, who hold about 40 per cent of Westinghouse shares as collateral, are expected to take their pro rata shares according to the provisions of the Merchandise Creditors' plan, leaving $3,000,000 to be subscribed for by individual stockholders. The work of obtaining these subscriptions has been in charge of a stockholder's committee which began its operations on April 8 and has already obtained the signatures of more than 500 stockholders. Mr. George M. Verity, secretary of the Merchandise Creditors' Committee, speaking of the work of that committee, said: "Considering the length of time we have been at work, a little more than 20 days, we are highly satisfied with the progress of the plan. Already signatures for $3,500,000 out of a possible $4,250,000 have been received, representing most of the larger creditors. The committee alone represents $7,500,000 and returns are coming in rapidly. In fact, it is only necessary to explain the plan to those interested to gain their hearty co-operation. The good results to be obtained by the carrying out of the plan and the evils which will result if other means are made necessary are too evident to render its failure at all likely. The Westinghouse Electric Company is too large and too much of a factor in the industrial world to be held back by temporary financial difficulties and as soon as the creditors are made to realize this fully they stand ready to support the plan. We are really a subordinate committee of the Readjustment Committee and have until May 15 to carry out our end of the arrangements. With the adjustment of debt as proposed and the ample cash funds which will be provided by the stock subscriptions, the company will be in a better position than at any other period in its history. And it is of vital interest to the creditors that the company be placed in such a position that it will not be crippled in any way or its effectiveness diminished by lack of funds. About one-third of the debt ranges in amounts from $1,000 to $800,000 and the number of creditors is about 1500. The creditors are classed in the following districts: New York, Philadelphia, Cincinnati, Pittsburg, Boston and Chicago. One member of our committee has charge of each district, getting in touch with each creditor either personally or by writing."

MEETINGS AND DIVIDENDS.—The Electric Properties Company has declared an annual dividend of 6 per cent on the preferred stock and subscription receipts, payable May 11. The annual meeting of the Electric Company of America was held last week in Camden, N. J., merely routine business being transacted. During the year the following three changes took place: Mr. G. B. Roberts, Mr. H. S. Kerbaugh, and Mr. J. E. Hayes, directors, resigned, and were succeeded by Mr. C. R. Snowden, Mr. E. D. C. Catherwood and Mr. John B. Morton. The other old directors were re-elected. The directors of the United Electric Securities Company have declared the regular semi-annual dividend of 3½ per cent, payable May 1, to stock of record April 21. The guarantee dividend of the American Telegraph & Cable Company will be paid on June 1. The annual meeting of the stockholders of the Interborough Rapid Transit Company will be held on May 13 to elect five directors to hold office for three years, and to ratify an agreement with the Manhattan Railway Company, dated April 23, 1908. At the annual meeting of the Atlantic & Pacific Telegraph Company the old directors were re-elected. The Consolidated Gas Company, of New York, has declared the regular quarterly dividend of 1 per cent, payable June 15, to stock of record May 20.

KINGS COUNTY ELECTRIC.—The quarterly report of the Kings County Electric Light & Power Company for the period ended March 31 shows earnings of $49,992.51. Deducting charges for replacement and depreciation of $66,472.71, leaves a balance of $424,472.71. Deducting fixed charges of $151,640 and a quarterly dividend of 2 per cent, or $200,000, leaves a balance of $84,462.71. The statement shows that the company earned for the first quarter at the rate of 11.3 per cent a year on the capital stock of the corporation, and these earnings will be materially increased from now on by the opening of the summer season at Coney Island, which means a big increase in revenue. During the last few weeks the stock of the Kings County Electric Company has advanced from 90 to 110, through transactions of a private nature, insiders taking stock.

INTERBOROUGH NOTES.—The subscription lists for the $25,000,000 of Interborough Rapid Transit Company three-year convertible 6 per cent gold notes, dated May 1, 1908, and payable May 1, 1911, were opened at 10 o'clock, April 29, by J. P. Morgan & Company, and closed at the end of an hour. It was announced that the notes were heavily oversubscribed, and it is understood that the subscriptions were three to four times in excess of the issue. The notes were offered at par and are secured by $30,000,000 45-year gold mortgage 5 per cent bonds of the company. In the allotment preference was given to holders of the $15,000,000 Interborough Rapid Transit Company notes, maturing on May 1, 1908. It is said that more than $10,000,000 of the old notes were offered in exchange for the new notes.

BLANKET MORTGAGE BONDS FOR $50,000,000.—Final arrangements have been completed by counsel for the Public Service Corporation of New Jersey to secure a bond issue of $50,000,000, which the company will put forth and which will cover its entire holdings. The proposed issue follows a proposal recently rejected by the board of directors, which also comprises the governing board of the Public Service Railway Company, for a $25,000,000 bond issue, the proceeds of which were to be used in the improvement of the North Jersey trolley lines owned by the latter company. The plan does not contemplate the sale of all the authorized issue at the present time, and, as a matter of form, no definite action will be taken until the plan is ratified by the Public Service Corporation stockholders.

AMERICAN DISTRICT TELEGRAPH.—The report of the American District Telegraph Company for the year ending Dec. 31, 1907, shows gross earnings of $3,017,174, an increase of $217,550, or 7.7 per cent, over the preceding year. Expenses were $2,304,214, an increase of $220,416, or 10.5 per cent, leaving a net of $712,960, which was $2,886 less than in the preceding year. Dividends of $396,899 were declared, which left a surplus of $316,061 and a total surplus of $1,246,570. The balance sheet as of Dec. 31 shows a decrease of $12,249 in cash, as compared with a year ago, when it amounted to $135,909. The profit and loss surplus increased $314,433.

BOSTON EDISON ELECTRIC BONDS AWARDED.—The Edison Electric Company of Boston has awarded to Perry, Coffin & Burr the $100,000 first mortgage 5 per cent bonds, due Dec. 1, 1930, which were recently authorized by the Gas Commission. This is the remainder of a total authorized issue of $200,000.

CANADIAN GENERAL ELECTRIC COMPANY.—The report of the Canadian General Electric Company for the last fiscal year ended Dec. 31, 1907, shows gross profits of $722,433, against $855,675 for the preceding year.

GENERAL NEWS

Late items are printed unclassified at end of department

Construction News.

BESSEMER, ALA.—The People's Home Telephone Company is planning to install an entirely new system in this city.

FOLEY, ALA.—The Consumers' Service Company has been organized and proposes to establish an electric light and power plant and water works system. Frank Fesler is interested in the project.

HEADLAND, ALA.—The city has awarded the contract for the construction of the municipal electric light plant and water works system, at an approximate cost of $23,500.

LINEVILLE, ALA.—Plans are being considered by the Clay County Telephone Company to extend its telephone lines.

MONTEVALLO, ALA.—Bids will be received by the President of the Alabama Girls' Industrial School for the construction of a brick power house and boiler room. William E. Spink, Title Guarantee Building, Birmingham, is the architect.

OPELIKA, ALA.—Preparations are being made for the construction of the proposed electric railway from Opelika to Eufala and thence to the coast by the Alabama Railway & Electric Company, work on which will commence at an early date. Judson C. Chapman, of Atlanta, Ga., is interested in the project.

GRIDLEY, CAL.—The citizens have voted in favor of establishing a municipal electric light plant and water works system.

HEALDSBURG, CAL.—The Petaluma-Santa Rosa Railway Company has recently established an automobile service between Sebastopol and Healdsburg pending the extension of its railway to this place.

MODESTO, CAL.—Plans are being considered for the construction of an interurban electric railway through Stanislaus County by John Hays Hammond, engineer of Guggenheim Exploration Company, and E. A. Willtsee. It is proposed to erect a power plant on the Toulumne River to furnish electricity and to build and operate electric railways in all of the cities of northern San Joaquin Valley, with Modesto as the center. Another line will be built from Turlock and Newman and across the Pacheco Pass to the coast.

OROVILLE, CAL.—It is announced that the Humbug Valley power plant is but one of a number of plants that the Oro Water, Light & Power Company propose to construct.

PASADENA, CAL.—The City Council has awarded contracts for equipment for the electric lighting contracts as follows: For 15,800 pounds of No. 6 triple braid weather-proof drawn copper wire to the California Electric Company, for $2,464; to J. B. F. Kierulff, Jr., & Company, for poles, crossarms and braces, for $5,843. Herman Dyer is city clerk.

PASADENA, CAL.—Bids will be received at the office of the city clerk until May 12 to furnish material and equipment for the municipal electric light plant as follows: Single-phase transformers rated at from 5 to 50 kilowatts, 60 cycles, 2200 volts primary; 110 or 220 secondary voltage. Transformers to be designed for a high all-day service. Separate proposals will be received on three-phase transformers of the same rating. Proposals will also be received for single-phase induction integrating wattmeters.

PLACERVILLE, CAL.—J. W. White, of San Francisco, has been engaged to prepare plans and estimates of the proposed municipal electric light plant.

PLACERVILLE, CAL.—The American River Electric Company is remodelling its power station on the American River near here. Four Doble water wheels have been installed at a cost of $10,000. The new wheels have a rating of 600 hp. and take the place of the Pelton wheels placed five years ago. A large switchboard has also been received and other improvements made. R. H. Sterling is manager.

PLACERVILLE, CAL.—James O'Brien and Robert Duncan have filed a notice of appropriation of 5000 cu. in. of water on the main fork of the Cosumnos River to be utilized for power, mining, irrigating and other purposes. A notice has also been filed by Norval Douglas appropriating 5000 cu. in. in Travis Creek, the point of diversion to be at the Lower or Big Falls in El Dorado County to be used to generate electrical power.

REDDING, CAL.—The Northern Light & Power Company has made application to the City Trustees for a franchise giving it permission to erect transmission lines for the distribution of electricity through the streets and alleys in the city. The company expects to have its plant in operation by the end of the year.

SAN FRANCISCO, CAL.—Bids will be received by the State Board of Prison Directors, San Francisco, until May 11 for an electric plant for Folsom State Prison at Represa. Plans and specifications can be obtained at the office of the board and at the office of the state engineer, Sacramento. E. Herriott is secretary of the board.

SAN FRANCISCO, CAL.—Agents of E. H. Harriman are said to have secured valuable water rights located in the mountains of Kern County, east of Bakersfield, in Fresno County, east of Fresno, in El Dorado County, on the Rubicon River, and on the Klamath River, in Siskiyou County, near Chase's place. It is stated that fully $15,000,000 ultimately will be spent in developing power at these points.

SANTA CRUZ, CAL.—The City Council has decided to call an election to vote on the proposition to issue $200,000 in bonds for the electric light plant, sewers, etc.

STOCKTON, CAL.—The City Council has granted the Central California Traction Company a franchise for an electric railway.

WEAVERVILLE, CAL.—The North Mountain Power Company contemplates the construction of another power plant to supplement the one now operated on the Trinity River below Junction City, for which surveys have been made and plans adopted. The plant will be located at Big Flat.

CANON CITY, COL.—The Colorado Telephone Company is to build a telephone line to Royal Gorge, which is to be used in connection with the proposed city water works system.

CASCADE, COL.—Plans are being made by the Cascade Town Company for the construction of an electric light plant. C. E. Heyer is manager.

DENVER, COL.—The Town Council of Littleton has granted to the Denver & South Platte Railway Company a permit, pending the passage of a franchise ordinance, allowing the company to construct its railway through the town. Work will commence at once on the extension of the road up the Platte River to Roxbury Park and Colorado Springs. William J. Coursin, of Pittsburg, Pa., has charge of the work, and W. E. Hughes, of Denver, is president.

LAY, COL.—The Maybell Valley Telephone Company is in the market for equipment for a telephone line 65 miles long, with branch lines, which will include telephone instruments, 10,000 lb. hard-drawn copper wire, 9000 lb. galvanized iron wire, 2000 cedar poles, insulators, etc. W. T. Stillings is manager.

WILMINGTON, DEL.—The West Chester & Wilmington Electric Railway Company has awarded a contract for the construction of its proposed electric railway between this city and West Chester to the Eastern Railway Construction Company. The contract includes the construction of the railway, power house and entire equipment. The power house will be located at Brandywine Summit.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the superintendent of the United States capitol, building and grounds, until May 2 for electric fans for use in the office building, House of Representatives: 100 16-in. swivel and trunnion desk fans, 120 volts, direct current, three speeds, black japanned bodies, heavy brass guards and blades. Each bid to be accompanied by a sample fan. Elliott Woods is superintendent of U. S. capitol building and grounds.

WASHINGTON, D. C.—Bids will be received until May 12 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yards and naval stations the following supplies: Puget Sound, Wash.: Schedule 1047—4 motor-generator sets and switchboards; 12 single-phase transformers; 2300 ft. rubber-covered braided cable. Charleston, S. C.: Schedule 1106—2 feeder panels. Brooklyn, N. Y.: Schedule 1107—82,000 ft. wire. Norfolk, Va.: Schedule 1107—1800 ft. conductor and 1450 ft. lighting wire. Boston, Mass.: Schedule 1155—switchboard. Bids will also be received until May 19 as follows: Mare Island, Cal.: Schedule 1088—12 electric drills; schedule 1090—soft-rolled copper; 20,000 lb. rolled sheet-zinc plate; schedule 1091—seamless drawn copper tubing. Applications for proposals should designate the schedule desired by number. E. B. Rogers is paymaster-general, U. S. N.

DE LAND, FLA.—The De Land Electric Light, Power & Ice Company has filed articles of incorporation with a capital stock of $100,000. J. Howell Cummings is president of the company.

LYONS, GA.—The citizens have voted in favor of the proposition to issue bonds for the construction of an electric light plant.

SYLVESTER, GA.—The city has voted to issue $10,000 in bonds for the construction of an electric light plant.

BOISE, IDAHO.—It is stated that the Gooding-Milner Electric Railroad contemplates extending its railway southward to Wells, Nev., and to the north across Camas Prairie to Boise. Surveys have already been made of both routes, and it is announced that work on construction of the roads will soon commence.

LEWISTON, IDAHO.—Plans are being made by the North Coast Power Company for the construction of a large power plant on the Clearwater River, near Lewiston. The plant will have an output of about 50,000 hp and will furnish energy to operate a system of interurban lines connecting Lewiston with Clarkston, Asotin, Anatone, Cloverland and Pomeroy. The proposed dam is to be located on the Clearwater River, near Porter's Island, about four miles above Lewiston. Work has commenced on a temporary plant, which is to furnish power to use in the construction of the dam. Frank McKean has charge of the engineering work.

POCATELO, IDAHO.—The Bear Lake Electric Company has decided to make improvements to its system and will construct a new power house and develop the water power of Paris Creek.

SANDPOINT, IDAHO.—J. F. Reynaud, manager of the Pend D'Oreille Electric Company, writes that the company has placed an order with the Allis-Chalmers Company for a heavy duty Reynolds Corliss engine; one 225-kw Bullock, two-phase, 2300-volt generator; one four-panel switchboard fitted with General Electric instruments. Boilers, condensers and pumps have been ordered from the Platt Iron Works, of Dayton, Ohio. The plant will be equipped for an output of 425 kw. Plans are being prepared for the development of a water power, with a transmission line 44 miles in length and an output of 4000 kw, the cost of which is estimated at $250,000.

WATSON, ILL.—The East Watson & Gilmore Telephone Company has been reorganized and its name changed to the Watson Telephone Company. The capital stock has been increased from $1,600 to $4,800. Plans are being made by the new company for improvements and extension to the system.

WAUKEGAN, ILL.—The plant of the North Shore Electric Light Company was wrecked April 23, causing a loss of $30,000.

CHERUBUSCO, IND.—Arrangements are being made by the Geiger Telephone Company to improve and rebuild its system in this city. The company is also planning to build several additional farm lines.

EVANSVILLE, IND.—Plans are being considered to extend the Evansville & Eastern Electric Railway from Rockport to Louisville in the near future.

FORT WAYNE, IND.—The Fort Wayne & Wabash Valley Traction Company has made arrangements with the Indiana Union Traction Company to supply electricity for operating the Bluffton branch. C. D. Emmons is general manager of the Fort Wayne & Wabash Valley Traction Company.

MICHIGAN, IND.—The Merchants' Mutual Telephone Company is in the market for telephone equipment, including 15,000 ft. paper cover and lead encased cable of all sizes from 25 to 200 pair, cedar poles, insulators, etc. George H. P. Barnum is manager.

NOBLESVILLE, IND.—We are informed that the hydro-electric power development on the White River will be completed this year. Plans and specifications are being prepared by H. von Schon, County Bank Building, Detroit, Mich., consulting engineer. The work consists of the construction of a reservoir and a system of waste gates. The power station was built some years ago. The equipment will have a rating of 600 kw. Electricity will be transmitted to Noblesville, two miles distant.

RICHMOND, IND.—The city is asking for bids for the furnishing of meters for the present year. There are about 1600 meters used in the city by the municipal system.

RICHMOND, IND.—E. E. Witherby, representing the syndicate which controls the plant of the Richmond Light, Heat & Power Company, has submitted an offer to the City Council for the municipal electric light plant. Mr. Witherby declares that the city has expended approximately $39,000 more than it should have paid out during the time it has operated the plant, and renews his offer, on behalf of the company, to purchase the plant and agrees to pay the city not only the cost of the construction of the plant, but to reimburse the city for the maintenance of plant during the period of municipal ownership. In addition the company offers to enter into a contract to maintain a schedule of rates that will conform with those the city now has in force and to provide a street lighting system that will cost less by $10 a lamp than it now costs the city to maintain its own lamps.

WILLIAMS, IND.—Senator Hemenway has secured the necessary authority from the Federal Congress for the construction of a dam in White River at this place. The purpose is to generate electricity for light and power purposes and especially to furnish power for the cement factories in the vicinity of Bedford. A company recently incorporated will carry out the enterprise.

CEDAR RAPIDS, IA.—The Cedar Rapids & Iowa City Railway & Light Company is in the market for a 750-kw motor-generator set to be used for railway purposes. G. Dows is president and general manager.

IOWA CITY, IA.—The Johnson County Telephone Company contemplates the construction of a long-distance telephone line between this city and Des Moines, the cost of which is estimated at about $6,000.

MASON CITY, IA.—The Western Electric Telephone Company is planning extensive improvements and extensions to its telephone line in this city and in northern Iowa, which will involve an expenditure of about $100,000.

MISSOURI VALLEY, IA.—The citizens on April 28 voted in favor of granting a franchise to L. D. Gascho for an electric light plant.

ARGENTINE, KAN.—The Metropolitan Street Railway Company is planning to improve its service in Argentine and will lay two miles of double track.

CONCORDIA, KAN.—The plant and holdings of the Concordia Electric Light Company have been sold to L. K. Green, of Osborne, who, it is said, will make improvements to the plant.

KIOWA, KAN.—The citizens have voted to issue $12,000 in bonds for the erection of an electric light plant and $40,000 for the construction of a water works system. Burns & McDonnell, of Kansas City, Mo., are the consulting engineers.

LEAVENWORTH, KAN.—Bids will be received at the office of the superintendent of prisons and prisoners, Department of Justice, Washington, D. C., until May 27, for furnishing and delivering at the United States Penitentiary, Leavenworth, Kan., distributing panel, cables, conduit and switches and other electrical supplies in accordance with specifications, copies of which may be obtained upon application at the office of the superintendent. R. V. La Dow is superintendent.

HOUMA, LA.—Preparations are being made to begin work on the construction of the proposed municipal electric light plant. J. Posey Campbell is mayor.

HOULTON, ME.—The Houlton Water Company has recently installed a 15-kw, three-phase generator in its station to be used in case of accident to the Aroostook Falls plant.

HAGERSTOWN, MD.—The report of the manager of the municipal electric light plant shows a net profit of $7,000 for the year, allowing $50 per lamp for street lamps, of which there are 144. Additional improvements to the plant are contemplated, including a new condenser. Another arc lamp circuit will be established.

NORTH ADAMS, MASS.—The citizens on April 16 voted to appropriate $1,200 to install an electric light plant at the town farm.

PITTSFIELD, MASS.—Application has been made to the State Board of Railroad Commissioners by the Berkshire Street Railway Company to increase its capital stock by $285,000.

PITTSFIELD, MASS.—The Pittsfield Street Railway Company has petitioned the Selectmen of Hancock for permission to extend its railway through that town. The proposed road will be extended from the present terminus of the West Pittsfield line. P. C. Dolan is superintendent.

SPRINGFIELD, MASS.—The Springfield Street Railway Company has applied to the State Board of Railroad Commissioners for permission to issue $500,000 additional capital stock.

WINCHENDON, MASS.—The Winchendon Electric Light & Power Company is removing part of the machinery from its present power house on Elm Street to the station purchased last fall on River Street, which will be used as an auxiliary to the Elm Street plant.

FLINT, MICH.—The Oak Park Power Company is planning additions to its plant which will involve an expenditure of $60,000. A 1000-kw generator and a cross-compound Corliss engine will be added, together with three 300-hp boilers. An air compressor with a capacity of 960 cu. ft. per minute will be installed. The plant furnishes electricity for motors for the Buick Motor Company and the Weston-Mott Company.

WAYNE, MICH.—The People's Telephone Company has increased its capital stock from $6,000 to $12,000, the proceeds to be used for building new lines.

WYANDOTTE, MICH.—Plans are being considered by the Home Telephone Company, of Detroit, for the installation of a telephone system in this city. The company has applied to the City Counsel for permission to erect its lines on Twelfth Street for its long-distance line from Detroit to Toledo, and an application will soon be made to install a local system.

BRAINERD, MINN.—Plans have been prepared by O. Claussen, St. Paul, for an electric power plant and water works to cost about $150,000. H. J. Spencer is city clerk.

ST. PETER, MINN.—The contract for installing two generators in the municipal electric light plant has been awarded to the General Electric Company, of Schenectady, N. Y., for $1,274.

WINONA, MINN.—The Winona Telephone Company is planning extensive improvements and extensions to its system in this city.

NATCHEZ, MISS.—The city has extended the time for awarding the contract for public lighting to June 17. This action was taken on account of the Southern Light & Traction Company, which holds the present contract, having been declared a trust, and it will take six weeks to sell the property and reorganize the local company.

OXFORD, MISS.—Plans are contemplated for the construction of a new electric light plant and water works system to cost about $15,000. The present distributing system will be used.

POPULARVILLE, MISS.—The citizens have voted in favor of the proposition to issue bonds for extending the electric light and water works systems.

VICKSBURG, MISS.—It is reported that the electric light franchise granted by the city to Harry K. Johnson will be purchased by Edward M. Dean & Company, of Grand Rapids, Mich. The new company proposes to place its wires underground on Washington Street before the street is paved.

ST. JOSEPH, MO.—Plans are being made by the Interstate Telephone Company for extensive improvements and extensions to its local service and the surrounding towns.

ST. LOUIS, MO.—The Kimmswick & Northern Railway Company has applied for a franchise to lay tracks on certain streets in the southwestern part of the city, with a terminus at Ivory Avenue and Broadway. This is said to be part of the scheme to connect Crystal City, about 10 miles south of the city, by an electric railway with the United Railways Company's line in South St. Louis.

HELENA, MONT.—The Elling estate has commenced work on the construction of the Blaine Springs power plant, which will furnish electricity for the Easton Mine, and also for lighting Virginia City. The plant will be located on the Blaine Springs Creek, about 16 miles distant from the mine.

TOWNSEND, MONT.—N. S. Poole, president of the Deep Creek Improvement Company, writes that the company proposes to construct a 600-hp plant on Deep Creek at a cost of about $85,000 to furnish electricity for lighting Townsend and for the mines at Radersburg. The company also proposes to develop the falls of Crow Creek at a cost of $120,000, and will probably furnish electricity to Elkhorn, Basin and perhaps to Boulder.

WAHOO, NEB.—John Martz, superintendent of the municipal electric light plant at Seward, has been appointed consulting engineer of the proposed municipal electric light plant and water works system, for which the citizens recently voted to issue $65,000 in bonds.

HIGH BRIDGE, N. J.—The Borough Council has passed a resolution to call an election to vote on the proposition to issue $15,000 in bonds for the erection of a municipal electric light plant to furnish electricity for both public and domestic lighting.

BERGEN, N. Y.—The Genesee County Electric Light, Gas & Power Company has awarded the contract for the construction of its power house in Bergen to Sanford Wilcox. The company has purchased a dynamo, switchboard and the pole line from the estate of B. L. Lewellyn for $750.

HUDSON, N. Y.—Proposals will be received by the Common Council until May 5 for lighting the streets and the city hall for a term of three years, and also for a term of five years, beginning Sept. 15, 1908.

NEW YORK, N. Y.—Bids will be received until May 11 by C. B. J. Snyder, superintendent of school buildings, for installing electric equipment in Public School No. 24, Borough of Brooklyn.

ONEIDA, N. Y.—The company which has leased Sylvan Beach is contemplating the construction of an electric light plant. The company will use 1000 lamps in the park, and will also furnish electricity for lighting the entire village of Sylvan Beach.

PLATTSBURG, N. Y.—The Clinton Telephone Company has decided to make several extensions to its lines.

SCHENEVUS, N. Y.—Extensive improvements are contemplated by the Home Telephone Company including the installation of a new switchboard, the overhauling of its toll lines leading out of Oneonta and the completion of the toll lines running south to Kingston.

SLATER SPRINGS, N. Y.—To take care of its increasing business the Carolina Telephone Company contemplates the construction of another telephone line to Ithaca.

ASHEVILLE, N. C.—The plant and holdings of the North Carolina Power Company, which includes a power plant of 600 hp and water rights and properties on the French Broad River, have been purchased by W. T. Weaver and associates. Mr. Weaver has been appointed president of the reorganization and W. E. Reid, secretary and treasurer.

GOLDSBORO, N. C.—The commissioners of the municipal electric light plant are contemplating increasing the output of the plant, at a cost of about $10,000.

ROCKY MOUNT, N. C.—Plans are being prepared for the proposed improvements to the municipal electric light plant and water works system.

GRAFTON, N. D.—The municipal electric light plant was damaged by fire, entailing a loss of about $5,000.

CARTHAGE, OHIO.—Bids will be received at the office of John Kuderer, secretary of Trustees of Public Affairs, until June 1 for furnishing labor and material for a new arc lighting system for the municipal electric light plant, consisting of a generator, switchboard, wiring and arc lamp equipment, in accordance with plans and specifications on file at the above office.

CINCINNATI, OHIO.—The Interurban Railway & Terminal Company has recently placed orders for the construction of a new substation and the following equipment: Two 250-kw rotary converters with transformers and switchboard complete; one quadruple 75-hp car equipment and two Christensen air-brake equipments to the Allis-Chalmers Company, of Milwaukee, Wis. The Westinghouse Electric & Manufacturing Company was awarded a contract for two quadruple 50-hp car equipments. The company also purchased two freight cars.

CLEVELAND, OHIO.—An ordinance has been introduced in the City Council to authorize the Board of Public Service to expend $2,000 to furnish a lighting plant for the Fairmount pumping station.

COLUMBUS, OHIO.—The Ohio Senate has passed the bill introduced by Mr. Hillenkamp, which provides that unincorporated districts may contract for street lighting and levy a tax to pay for it if the owners of one-half the abutting property so petition.

LEWISBURG, OHIO.—Plans are now being prepared for the installation of a municipal electric light plant and water works system.

SANDUSKY, OHIO.—Bids will be received by the Board of Trustees of the Soldiers' and Sailors' Home, Sandusky, Ohio, until June 1 for furnishing three or four boilers of 200 hp to be installed in connection with the power plant of the Home. Bids will also be received for steam pumps. Daniel Dugan is quartermaster.

MARSHALL, OKLA.—The installation of a new switchboard and building of several rural lines is being considered by the Marshall Telephone Company.

WAURIKA, OKLA.—It is reported that the O'Neil Engineering Company, of Dallas, Tex., has been granted a franchise to construct a new lighting plant. The cost of the plant is estimated at $100,000.

GRESHAM, ORE.—The Portland Railway, Light & Power Company has installed an electric lighting system at this place and also has a contract for lighting the streets of the city. Electricity for operating the system is supplied from the Cazadero plant.

KLAMATH FALLS, ORE.—Plans are being made by the Klamath Falls Electric Railway Company for extensions to its street-car system during the summer. The company expects to complete the Belt Line, for which negotiations for rails are under way. E. R. Reames is local manager.

PORTLAND, ORE.—The United Railways Company, it is said, will soon begin preliminary work on the construction of an electric railway from Portland to Tillamook, Netart's Bay and Bay City, a distance of about 88 miles. A. C. Emmons is secretary of the company.

PORTLAND, ORE.—Plans for extensive improvements and extensions have been announced by the Oregon Electric Railway Company, which include the construction of a system of interurban railways aggregating about 250 miles. The capital stock of the company has been increased from $2,500,000 to $10,000,000. Work will commence at once on the Garden Home-Hillsboro road. The officers of the company are: George Barclay Moffatt, of New York, N. Y., president; Guy W. Talbot, of Portland, vice-president; George F. Nevins, of Portland, secretary, and H. W. Brower, of New York, N. Y., treasurer.

CLARKSVILLE, PA.—The erection of additional telephone line between this city and Zollarsville is being considered by the Clarksville Telephone Company.

FOREST CITY, PA.—The Forest City Electric Light, Heat & Power Company has awarded contracts for new equipment for its plant as follows: To the Westinghouse Machine Company, of Pittsburg, Pa., one 175-kw, two-phase alternator, 30 magnetite arc lamps, switchboards and exciter; to the American Ball Engine Company, of Bound Brook, N. J., one 350-h.p. engine, and the Keeler Boiler Company, of Williamsport, Pa., for two 150 h.p. boilers. Work will commence on improvements at once. A. D. Kehren is superintendent.

NEWTOWN, PA.—The Bucks County Electric Railway Company is reconstructing its entire system and installing modern equipment. This company is a consolidation of the Newtown Electric Street Railway Company and the Newtown, Langhorne & Bristol Trolley Street Railway. The railway extends from Bristol to Doylestown, a distance of about 27 miles. Frank Battles is president.

PITTSBURG, PA.—The Central District & Printing Telegraph Company will extend its lines in the Pittsburg district. The cost of the improvements is estimated at about $1,000,000.

STROUDSBURG, PA.—The Stroudsburg & Water Gap Street Railway Company contemplates increasing the equipment of its power house and will soon place contracts for a 250 or 300-hp slow-speed engine and a 100-hp boiler. H. E. Sweeney is president of the company.

WILKES-BARRE, PA.—Bids will be received by James M. Norris, county controller, until June 5 for furnishing and installing complete the electric lighting fixtures for the new Luzerne County court house. An appropriation of $35,000 has been made for the work.

BATESBURG, S. C.—It is reported that the water power privileges near Batesburg have been purchased by E. F. Strother, who it is said will develop them.

SPARTANBURG, S. C.—It is reported the Electric Power & Manufacturing Company has purchased the plant and holdings of the Spartanburg Street Railway, Gas & Electric Company. It is understood that extensive improvements will be made to the railway system. R. C. Crawford, of Pittsburg, Pa., is president of the Electric Power & Manufacturing Company.

FORT MEADE, S. D.—Bids will be received at the office of the constructing quartermaster until May 25 for installing steam heating, electric wiring and electric lighting fixtures in the following buildings: One set of commanding officers' quarters; one double set of lieutenants' quarters; one set of bachelor officers' quarters; one band barrack and administration building. Plans and specifications may be seen at the offices of the chief quartermaster, Department of Missouri, Omaha, Neb.; Department of Colorado, Denver, Col.; Department of the Lakes, Chicago, Ill.; Department of Dakota, St. Paul, Minn.; Depot Quartermaster, St. Louis, Mo., and at the Fort Meade office, at which place all information may be obtained upon application. Captain L. C. Scherer is constructing quartermaster.

VIENNA, S. D.—The establishment of an electric lighting system in this town is under consideration.

LEWISBURG, TENN.—A company has been organized here, of which E. L. Aschheim was elected president, Dr. S. T. Hardison, vice-president, and J. B. Hardison, secretary and treasurer. The company proposes to construct a power plant at Lillards Mills, on Duck River, ten miles north of the city. The company will also install two steam engines to use in case of accident or low water. The company proposes to furnish electricity in Lewisburg for lamps and motors and to give a 24-hour service. The cost of the plant is estimated at $30,000.

McKINNEY, TEX.—The city has decided to issue $26,000 in bonds for extensions to the electric light plant and water works system.

OGDEN, UTAH.—Bids will be received by James Knox Taylor, supervising architect, Washington, D. C., for the installation of a conduit and electric wiring system in the extension to the United States post office and court house building at Ogden, Utah.

ASCUTNEYVILLE, VT.—Surveys are being made of the L. H. Bailey water privilege with a view to installing an electric light plant. Rush Chellis is engineer.

RUTLAND, VT.—The Board of Aldermen has accepted the proposition of the Rutland Railway, Light & Power Company, whereby the city will save about $3,000 on the five-year contract. Under the new arrangements the company is to furnish arc lamps to burn until 12:30 a. m., at $66.65 per lamp per year, and arc lamps on all-night schedule at $84.40 per lamp per year. Under the old rate the city paid $69.30 and $87.40 respectively. The rate for incandescent lamps and for the fire alarm system is to be 12 cents per kw-hour..

FREDERICKSBURG, VA.—It is reported that the Fredericksburg Power Company contemplates further development of its water power properties.

RADFORD, VA.—The Radford Water Power Company has just placed an order with the Westinghouse Electric & Manufacturing Company for a 1000-kw motor-generator set. J. A. Baird is secretary of the company.

RICHMOND, VA.—The receivers of the Virginia Passenger & Power Company have decided to offer special rates for electricity for electric signs, the price to be regulated by the number of lamps used, varying from five to 400 lamps, at from $5.18 to $36 per month, the lamps to burn from dusk until 9 o'clock in the evening.

CENTRALIA, WASH.—An election will soon be held to vote on the proposition to issue $45,000 in bonds to establish a municipal lighting plant.

NORTH YAKIMA, WASH.—The electric railway which the Yakima Inter-Valley Electric Railway Company proposes to build to Granger will be extended to Sunnyside. Work will commence as soon as the right of way is secured.

ORIENT, WASH.—Preparations are being made for the construction of a power plant for which the water power of Deer Creek will be utilized. Arthur Phillips and H. D. Merritt, who have been granted a franchise to furnish water and electricity for lamps and motors in this city, are interested in the enterprise. They propose to furnish a water supply and electricity for lamps and motors in Orient and the nearby mines.

PORT ANGELES, WASH.—The Independent Telephone Company and the Angeles Telephone & Telegraph Company have been consolidated, and plans are being perfected for extending the system throughout the county.

SNOHOMISH, WASH.—Announcement has been made that the Snohomish Valley Railroad Company has been financed and that work on the construction of the first 15 miles of the road will commence at once. The company proposes to build an electric railway from Snohomish to Issaquah, thence to Renton, and from there to Seattle and Tacoma. The company is capitalized at $2,500,000.

SPOKANE, WASH.—Plans are being prepared by George Nixon, of this city, to erect a power plant on the Little Spokane River about 10 miles from Chattaroy to furnish electricity in the towns of Chattaroy and Deer Park. Mr. Nixon has filed an application with the County Commissioners for a franchise to erect transmission lines over the county roads to furnish electricity in the above-named towns for light, heat and power purposes.

GRAFTON, W. VA.—The Consolidated Telephone Company has decided to take over the plant and holdings of the Terra Alta Telephone Company, and contemplates the construction of a new telephone line from Grafton to Newburg.

WELCH, W. VA.—The Welch Ice & Cold Storage Company has been granted a franchise to furnish electricity in this city. J. J. Rhodes is president of the company.

ALLENTOWN, WIS.—The Allentown-Kohlsville Telephone Company has been organized with a capital stock of $5,000. The company has purchased from the Theresa Telephone Company a telephone line, which it expects to extend to Huelsburg. The erection of a number of telephone lines east of Allentown is also contemplated by the company.

ATHENS, WIS.—The capital stock of the Athens Telephone Company has been increased from $6,000 to $15,000.

CAMERON, WIS.—The Cameron telephone exchange has been purchased by A. W. Larson, of Deerfield. The new owner proposes to improve the local service and build new lines to Deerfield and Fort Atkinson.

GRESHAM, WIS.—The citizens have voted to issue bonds to establish an electric lighting system.

KENOSHA, WIS.—It is said that the city has abandoned the fight for a municipal electric light plant as the new administration has declared itself in favor of making a new contract with the Kenosha Gas & Electric Company.

LOYAL, WIS.—The Village Board has awarded contracts for equipment for the municipal electric light plant as follows: For gas engine and producer to the National Meter Company, of New York, N. Y.; pumps to Goulds Manufacturing Company, of Seneca Falls, N. Y., and for generator and switchboard to the Western Electric Company, of Chicago, Ill.

MARTINTOWN, WIS.—Plans are being considered by E. B. Bucher, owner of the water power in this place, to install an electric plant to furnish electricity for lighting in the nearby towns.

EDMONTON, ALB., CAN.—The City Council has decided that it would be unwise to proceed with the construction of a municipal street railway system on account of the present financial conditions. It is expected a franchise will be given to some company to build a system. For further information address Mayor Macdougall.

FERNIE, B. C., CAN.—The Fernie Electric Light Company has made an offer to sell out its plant to the city. A special committee of the City Council is now considering the matter.

NEW WESTMINSTER, B. C., CAN.—The British Columbia Wood, Pulp & Paper Company, Vancouver, B. C., has applied for 20,000 cu. in. of water from the Cowholm River for power purposes to operate the plant now under construction.

WINNEPEG, MAN., CAN.—The Manitoba Government has provided about $300,000 for improvements and extension of the telephone system.

HALIFAX, N. S.—Extensive improvements and extensions will be made to the system of the Nova Scotia Telephone Company, which will involve an expenditure of about $200,000.

FOREST, ONT., CAN.—The People's Telephone Company has been incorporated with a capital stock of $20,000, by R. F. Scott, W. Lawrie and J. W. Bell.

FORT ERIE, ONT., CAN.—The Legislature of the Province of Ontario has passed a bill giving permission to the Fort Erie Ferry Railway Company to build extension to its present lines. The company proposes to build an electric railway extending along the Canadian frontier from Chippewa to Port Colborne. Frank J. Weber, president of the company, states that work will commence on the construction of the road this year.

HAMILTON, ONT.—The Cataract Power Company has notified the city clerk of its intention to appeal against the decision of Judge Snider in the street lighting arbitration matter. A reduction was granted to the city in the cost of street lamps from $85 to $70 per lamp per year.

TORONTO, ONT., CAN.—Pending the signing of the contracts by the municipalities, the Hydro-Electric Power Commission has had estimates prepared for the cost of the transmission lines to the various cities and towns which have passed by-laws to take electrical power from the commission. The cost of the lines is estimated at from $3,400,000 to $3,500,000. The estimates are based on the plan for the erection of a transmission line designed for 30,000 horse-power.

MONTREAL, QUE., CAN.—The Montreal Light, Heat & Power Company has made a reduction in its prices for gas and electricity. A discount of 10 per cent. will be allowed on one-year contracts for electricity, and on five-year contracts 50 per cent. will be allowed. The price of gas will be reduced from $1.20 to $1.15 per thousand cu. ft.

HERBERT, SASK., CAN.—Plans are being made to organize the Herbert Rural Telephone Company, which proposes to erect about 30 miles of lines. The officers of the company are W. H. Hallett, secretary; F. J. Dafehr, treasurer, and Franz Cornelson, manager.

MOOSEJAW, SASK., CAN.—The rate-payers will shortly vote on a by-law to raise $200,000 by the sale of debentures for improvements to the power plant, etc. For further information address John D. Simpson, city clerk.

PANAMA.—Bids will be received at the office of the general purchasing officer of the Isthmian Canal Commission, Washington, D. C., until May 23, 1908, for furnishing the following supplies: Wiring material, chandeliers, lamp shades, incandescent globes, cross-arm pins, magneto testing sets, dry cells, turn-buckles, brake arms, cable clamps and thimbles, wire cable, soldering paste, friction tape, varnish cambric, wire solder, insulating paint and varnish, mica, wire cutters, pliers, rubber gloves, etc. Blanks and general information relating to this circular (No. 439) may be obtained from this office or the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; Custom House, New Orleans, La.; also from the U. S. engineer offices in the following cities: Baltimore, Md.; Philadelphia, Pa.; Pittsburg, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky., and Mobile, Ala. Lt.-Col. H. F. Hodges is general purchasing officer.

New Industrial Companies.

THE TWENTIETH CENTURY ELECTRIC & REPAIR COMPANY, of Akron, Ohio, has been incorporated, with a capital stock of $10,000, by F. N. Harris, C. L. Bigler, J. M. Hassler, George J. Schaffer and N. K. Walters.

THE ELECTRIC VIBRATOR COMPANY, of Plainfield, N. J., has been incorporated, with a capital stock of $250,000, by Henry B. Suydam, George S. Jacob and Allen G. N. Vermilya. The company proposes to manufacture massage appliances.

THE CHAUTAUQUA ELECTRIC COMPANY, of Jamestown, N. Y., has been incorporated with a capital stock of $5,000 by Fred H. Baloon, of Jamestown; George B. Barrell and B. J. Shanahan, of Buffalo, N. Y. The company proposes to do general electrical work.

THE S. K. ELLIOTT ELECTRIC COMPANY, of Cleveland, Ohio, has been incorporated, with a capital stock of $150,000, by S. K. Elliott, Logan Myers, Clifford P. Billings, C. W. Elliott and K. M. Elliott. This company handles a line of motors and other electrical equipment.

THE AUTOMATIC ELECTRIC SIGNAL COMPANY, of Boston, Mass., has been incorporated, with a capital stock of $100,000, to manufacture automatic signals. The officers of the company are: S. A. Corbett, of Boston, Mass., president; F. L. Hall, of Winthrop, treasurer.

THE NUTTING-ROE ELECTRIC COMPANY, of Muncie, Ind., has incorporated to manufacture and sell all kinds of electrical equipment, generators, motors, switchboards, electric heating devices, lamps and electric light plant equipment, etc. J. R. Hummel, K. E. Nutting and W. L. Roe are the directors.

THE AUTOMATIC COIN-WRAPPING MACHINE COMPANY, of Plainfield, N. J., has filed articles of incorporation with a capital stock of $125,000. The company proposes to manufacture coin-wrapping machines and do a general electrical and mechanical engineering business. The incorporators are: R. D. Geswein, E. A. Sidman and H. L. Bell, of Plainfield, N. J.

New Incorporations.

NEWPORT, ARK.—The Newport Water, Light & Power Company has been incorporated, with a capital stock of $100,000, by N. V. and A. N. Walker, John A. Williams and L. Minor.

RECTOR, ARK.—The Rector Co-operative Telephone Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are J. W. Dollison, president; W. E. Lynch, J. B. Hafford, A. J. Sides, A. W. Gill, W. C. Cochran, R. A. Klope, T. A. Jones and others.

GRASS VALLEY, CAL.—The I.X.L. Telephone Company has been organized to build a telephone system between Grass Valley and Pet Hill.

DAYTONA, FLA.—The Daytona Telephone Company has been incorporated with a capital stock of $1,000. The officers of the company are: S. H. Gove, president; H. C. Thompson, secretary.

ADRIAN, GA.—Articles of incorporation have been filed for the Adrian Power Works, with a capital stock of $50,000, by J. E. Taylor, W. W. Strickland, of Adrian, and J. L. McKeaver, of Guthrie, Okla.

LEVERETT, ILL.—Articles of incorporation have been filed for the Somer Township Telephone Company with a capital stock of $8,000, by C. B. Fiatt, M. C. Busey and P. P. Dunn.

PIPER CITY, ILL.—The Piper City Telephone & Telegraph Company has been incorporated with a capital stock of $10,000. The incorporators are: James P. Glass, W. H. Roberts and J. A. Montelius, Jr.

WEST POINT, ILL.—The Tri-Mutual Telephone Company has been incorporated with a capital stock of $1,020, by W. H. Felger, J. I. Farnsworth and L. F. Miller.

ELK CITY, KAN.—The Farmers' Mutual Telephone Company has been chartered with a capital stock of $10,000.

GARDEN CITY, KAN.—Articles of incorporation have been filed for the Northwestern Mutual Telephone Company.

FRANKFORT, KY.—The Ballard County Home Telephone Company has been incorporated with a capital stock of $6,000 by J. F. Hahs, H. E. Morrow, L. S. Turner and others.

STEPHENSPORT, KY.—Articles of incorporation have been filed for the Stephensport Telephone Company with a capital stock of $500 by Andrew Crawford, R. A. Shellman, John S. Adair and others.

AUGUSTA, MAINE.—The North Fork Water Company has been incorporated with a capital stock of $500,000, for the purpose of conducting a mining business, selling water for irrigation purposes, also selling water and electrical power. J. Berry, of Augusta, is president and manager.

WATERVILLE, MAINE.—The Kennebec Farm & City Telephone Company has been incorporated with a capital stock of $10,000. The officers are F. E. Webster, of Skowhegan, president; F. L. Ames, of Norridgework, treasurer, and E. A. Webster, of Norridgework, clerk.

EAST SAUGATUCK, MICH.—The Farmers' Telephone Company has been incorporated to establish a telephone system in this city.

BATTLE LAKE, MINN.—The Battle Lake Mutual Telephone Company has been organized and the following named officers elected: Ludwig Jensen, president; William Bondy, vice-president; A. Bjorklund, secretary, and Knute Sandstrom, treasurer.

CHILLICOTHE, MO.—The Mutual Telephone Company has been organized in this city and the following officers elected: Z. B. Myers, president; H. P. Scruby, vice-president; C. F. Wykoff, secretary, and John McBride, treasurer.

SHERIDAN, MO.—Articles of incorporation have been filed for the Farmers' Mutual Telephone Company with a capital stock of $3,000.

FARMINGTON, N. H.—Articles of incorporation have been filed for the Cloutman Gas & Electric Company with a capital stock of $15,000.

ELLENBURG, N. Y.—The Ellenburg Telephone Company has been incorporated by F. H. Gardinier, N. W. McGaulley, J. H. Moore, F. L. Myers and others. The company is capitalized at $5,000.

HIGH POINT, N. C.—The Orinoco Telephone Company has been incorporated with a capital stock of $5,000 by C. E. Spurgeon, W. A. Motsinger, W. E. Swain and others.

DES LACS, N. D.—Articles of incorporation have been filed for the Ward County Farmers' Telephone Company. The company is capitalized at $19,950 and the incorporators are: William G. Varnes, T. M. Williams, E. S. Waterman and others.

TIPPECANOE, OHIO.—The Laurel Valley Telephone Company has filed articles of incorporation with a capital stock of $7,500. The incorporators are: S. F. Groves, N. S. Bower, S. A. Gurnincy, W. F. Owens and others.

ASHLAND, OKLA.—Articles of incorporation have been filed for the Ashland Telephone & Telegraph Company by J. W. Rose, S. H. Rose and Henry Judgemire. The company is capitalized at $2,500.

BEULAH (P. O. DOXEY), OKLA.—An independent telephone company has been organized by J. A. Corbell and others. The company is on the market for a 25-drop switchboard, telephones, wire, and other equipment.

CATAWISSA, PA.—The Farmers' Union Telephone Company has been incorporated with a capital stock of $5,000, to operate a telephone system in Columbia, Mantour and Northumberland Counties with headquarters at Catawissa.

CENTER HALL, PA.—The Patrons Rural Telephone Company has been incorporated with a capital stock of $10,000 for the purpose of installing a telephone system in Center, Clinton, Huntingdon, and Clair Counties.

LANDISVILLE, PA.—The Landisville Telephone Company has been organized to install a telephone system in this town.

McKEANSBURG, PA.—The McKeansburg Rural Telephone Company has filed articles of incorporation. The incorporators are: John Shoener, Oscar P. Leidensperger and William H. Matten.

GRANVILLE, TENN.—The Granville Home Telephone Company has filed articles of incorporation with a capital stock of $1,500 by H. S. Holleman, H. B. Smith, A. B. Hayes, J. H. Hargis and others.

McKENZIE, TENN.—The Rural Home Telephone Company has been chartered with a capital stock of $1,500.

ISLAND POND, VT.—The Essex Telephone Company has been chartered with a capital stock of $25,000 by O. T. Davis, M. K. Davis, Porter H. Dale, M. G. Davis and E. M. Bartlett, of Island Pond. The company proposes to install exchanges in this city and Brighton.

HERTEL, WIS.—The Independent Telephone Company has been organized to construct a telephone line from Hertel to Doran.

STEVENS POINT, WIS.—The Porter Telephone Company has been formed for the purpose of constructing a telephone system between Stevens Point, Stockton and Plover. The following-named officers have been elected: John Porter, president; John Britz, vice-president; A. F. Else, secretary, and J. P. Leonard, treasurer.

KIRTLEY, WYO.—The Pleasant Ridge Telephone Company has been incorporated with a capital stock of $5,000, to install a telephone system between Kirtley and Luck, and eventually throughout Converse County. The directors are: William P. Sargeant, Thomas H. Thompson, Harry R. Rogers, and Harry C. Snyder.

Legal.

RECEIVERS FOR FOSTORIA LIGHT PLANT.—The Fostoria City Heat & Light Company, of Fostoria, Ohio, was placed in the hands of receivers April 23, on application of the Consolidated Railway & Light Company, of Philadelphia, Pa. E. W. Allen, of Fostoria, and A. R. Law, of Philadelphia, Pa., were appointed temporary receivers. The indebtedness of the defendant company is placed at $365,000 with no assets.

SUIT TO PREVENT SALE OF FRANCHISE.—The Kentucky Electric Company has filed a suit for injunction against the Board of Public Work, of Louisville, Ky., to enjoin the city from selling on May 12 what is known as the Fetter franchise. The company claims that the ordinance was not passed by the Board of Council as required by law, and also states that the ordinance is void, for the reason that it excludes the Louisville Lighting Company and the Kentucky Electric Company, or any one bidding in their interests on the franchise when it is put up for sale. The ordinance, it is shown, is so drawn as to create a franchise solely for the George G. Fetter Lighting & Heating Company, and it is alleged that no other person could bid on the franchise in good faith or comply with its provisions.

EFFECT OF DELAY IN APPLYING FOR A PATENT.—The complainant in an action to restrain the infringement of a patent covering an improved telephone transmitter showed that the inventor of the device, who assigned it to the complainant company, conceived the invention in 1895. At that time he was working under a contract by which his employer was entitled to the benefit of any inventions which he might make during the course of his employment. For this reason he kept his invention a secret for six years and did not take steps to secure a patent on it until 1901. Meantime another inventor had conceived the same idea and applied for and was granted letters patent, the letters being issued subsequent to the patent of the first inventor. The patent issued to the second inventor was assigned to the defendant and in the present action the defendant claimed that the first inventor had abandoned the idea upon which the invention was based and was estopped to question the validity of the defendant's patent by reason of the long period of time which intervened between the conception of the invention by the first inventor and the time of his application for letters patent. It was held that, as there was no evidence of actual abandonment and as the prior invention was the first to give the idea to the

public, the plaintiff was entitled to restrain the defendant from interfering with its patent rights. In the language of the court an estoppel "could hardly be based upon what two men held locked up in their minds." Kellogg Switchboard Co. v. International Telephone Mfg. Co., United States Circuit Court, 158 Fed. 104.

Personal.

MR. BERNARD C. COBB has been appointed vice-president of the Saginaw-Bay City Railway & Light Company, of Saginaw, succeeding Mr. S. E. Wolff, recently resigned.

MR. B. W. MENDENHALL has resigned as manager of the Ely, Nev., Light & Power Company, to accept the position of commercial agent for the Utah Light & Railway Company, Salt Lake City. He has now taken up his new duties.

MR. HENRY B. IVERS, who for the past year has been assistant to the president and treasurer of the Bangor Railway & Electric Company, of Bangor, Maine, has been appointed general manager of the Lewiston, Augusta & Waterville Railway Company, of Lewiston, Maine.

MR. FREDERICK RALL has become the New York selling agent for O. C. White & Company, of Worcester, Mass., the manufacturers of the White adjustable incandescent lamp fixtures. He will have offices and headquarters at 16 Murray Street and 19 Park Place, and will carry a complete stock.

MR. JOSEPH E. WAYNE, formerly superintendent of the York Street Railway Company, of York, Pa., has been appointed general manager of the Waynesboro Electric Light & Power Company and the Chambersburg, Greencastle & Waynesboro Street Railway Company, of Waynesboro, Pa. Mr. Wayne assumed the management of the company May 1.

MR. IVAN OFVERHOLM, chief engineer of the electrification department of the Swedish Government Railways, arrived in New York April 30. The question of the electrification of the railways in the Southern part of Sweden is an important one owing to the high price of coal, and as is well known, the government engineers have been making a study of the possibilities of electrical energy. No detailed plans have yet been adopted. Mr. Ofverholm will visit a number of the most important heavy electric traction and single-phase railways while here, and expects to return to Sweden on May 27.

MR. H. R. FOTHERGILL, the engineer and manager of the Scholl Engineering Company, in resigning from the position of general superintendent of the Greenville Traction Company, superintendent of the Greenville Gas & Electric Light & Power Company and superintendent of the Paris Mountain Water Company, all plants of the American Pipe Manufacturing Company's syndicate, owned principally in Philadelphia, to again engage in the contracting business, was presented with a handsome gold watch by the employees as a token of their appreciation of his treatment to them and their desire to have him carry their good will wherever he might be. Mr. Fothergill has been identified with the electric railway and lighting trade for the past 15 years, particularly in power-plant construction, and enters his new field with two central station plants already turned over to him for construction.

Removals.

MR. JOHN BOGART, C. E., has removed his New York offices to 115 Broadway, New York City.

MR. A. A. KUNDSON, the electrolytic expert, has removed his offices in New York City to 50 Pine Street.

HARVEY & HILL have removed their general offices to suite 1880 Fulton Building, Hudson Terminal, 50 Church Street, New York City.

ELEVATOR SUPPLIES.—The Elevator Supply & Repair Company, New York City, has removed its offices to the sixth floor of 114 Liberty Street.

AMERICAN CIRCULAR LOOM.—The American Circular Loom Company has opened offices in the International Trust Building, 45 Milk Street, Boston.

THE ELECTRIC SERVICE SUPPLIES COMPANY has moved the offices of its New York sales department to the Hudson Terminal Building, 50 Church Street.

THE NEW YORK OFFICE of Messrs. McIntosh, Seymour & Company has been moved from 26 Cortlandt Street, to 50 Church Street, in the Hudson Terminal Building.

ALLIS-CHALMERS IN SAN FRANCISCO.—The district office maintained by Allis-Chalmers Company at San Francisco in charge of Mr. H. D. Scribner, manager, has been removed from the Atlas Building to the Phillips Building, 599 Mission Street. As it is only a step from one building to the other, callers will have no difficulty in finding the new location.

THE STANDARD GAUGE MANUFACTURING COMPANY, of Syracuse, N. Y., makers of indicating gages for all purposes, has moved its New York branch from 141 Broadway to Room 1770 Hudson Terminal Buildings. This change was made in order to obtain more spacious quarters for the display of a long line of engineering specialties, as well as to remain in the center of the downtown engineering community. The Western branch of the Standard Gauge Company is located in the Monadnock Building, Chicago, Ill.

Unclassified Items.

WATERLOO, IA.—The Waterloo, Cedar Falls & Northern Railway Company has filed a trust deed in Black Hawk County conveying the street railway and interurban property to Louis Boisot and the First Trust & Savings Bank, of Chicago, Ill., to secure a loan of $2,000,000, the proceeds of which will be used to extend its lines in this city and surrounding territory.

COUNCIL BLUFFS, IA.—The Omaha & Council Bluffs Street Railway Company has completed surveys for the extension of its line from this city to the School for the Deaf, for which contracts for construction of the road will soon be let. The road will be about two miles in length.

ROME, N. Y.—At the annual meeting of the Rome & Osceola Railroad Company the following named officers were elected: W. Pierrepont White, president; John D. McMahon, secretary and treasurer; executive committee: J. S. Haulton, David Swanscott, W. I. Taber and W. S. Jones.

MILLSBORO, DEL.—The Town Council is considering the question of establishing an electric lighting system in this town. Two propositions are under consideration: One to make an agreement with the Georgetown Light, Heat & Power Company to furnish electricity for lighting the town; the other is to form a stock company and utilize the water power of the Indian River to operate an electric light plant.

DAYTONA, FLA.—Adam Schantz has submitted a proposition to the City Council for the rebuilding of the electric light plant recently destroyed by fire. Mr. Schantz has asked the city for an extension of the present electric light franchise for 16 years, or 30 years from April 30, 1908, and an extension of the electric light contract for 10 years.

MONROE, LA.—Orders have recently been placed for new equipment for the municipal electric light plant, which include new boilers, engine, generators and other apparatus. The improvements to the plant will cost about $20,000.

BRIDGTON, ME.—At a special meeting of the Bridgeton Center Village Corporation it was voted to continue lighting the streets of the city by electricity. At its annual meeting the corporation refused to accept the proposition of the company, and the streets of the village have been in darkness since.

PITTSBURG, KAN.—The Joplin & Pittsburg Railway Company has placed a contract with the John A. Stewart Electric Company of Cincinnati, Ohio, for two 600-kw direct-connected units for railway service, and complete power house equipment, consisting of water-tube boilers, etc.

NEWBURGH, N.Y.—The Public Service Commission, second district, has authorized the Newburgh Light, Heat & Power Company to issue bonds to the amount of $330,000, the proceeds to be used for the discharge of its lawful obligations, and to pay for the cost of improvements to the electric light plant and extensions to line. The company applied for permission to isue $350,000.

BELLINGHAM, WASH.—A section of the transmission lines running from the main substation of the Noosack Falls Power Company was destroyed by fire April 23, entailing a loss of about $10,000.

PLATTSBURG, N. Y.—The Public Service Commission has authorized the Plattsburg Light, Heat & Power Company to issue $250,000 in bonds.

CHISHOLM, MINN.—The Northern Power Company has commenced work on the construction of a power plant six miles north of Chisholm. The plant will furnish electrical energy to the Northern Traction Company, and also for lamps in this city.

TAYLORVILLE, ILL.—The Taylorville Electric Railway Company has been incorporated to build a street railway line in Taylorville.

BILLINGS, MONT.—The Stillwater Power & Light Company has been incorporated to construct an electric railway from this city to Cooke City by the way of Columbus. Branches also will be built to Yellowstone, Sweet Grass, Carbon and Park Counties. The capital stock of the company is placed at $3,000,000, and the incorporators are: Willard Bennett, of Helena; George H. Savage, W. E. Durfresee and E. E. Congdon, of Butte.

RED OAK, IA.—Articles of incorporation have been filed for the Red Oak & Northwestern Interurban Promotion Company with a capital stock of $10,000, for the purpose of constructing an electric railway from Red Oak to Des Moines. The officers of the company are: B. B. Clark, of Red Oak, president; G. W. Curtis, of Redfield, vice-president; M. N. Spencer, of Red Oak, secretary; L. D. Goodrich, of Red Oak, treasurer.

Business Notes.

MARCONI WIRELESS TELEGRAPH COMPANY, 27 William Street, New York, is making a registration of cable code addresses. This is a good idea, though it sounds novel. Every user of the cable ought to put his code name on file for the wireless as well.

THE AMERICAN DISTRICT STEAM COMPANY, of Lockport, N. Y., originator of underground steam heating, will have an exhibit at the convention of the National Electric Light Association in Chicago. This company, with more than 31 years of experience, has developed the underground steam-heating business to such a degree of perfection that its exhibit will be worth the time to investigate it thoroughly. Every detail of the operation of both live and exhaust underground steam-heating systems will gladly be explained by the company's engineers and representatives who will be in attendance.

WESTERN ELECTRIC COMPANY will hereafter conduct in its own name the business which it has hitherto carried on in San Francisco for Pacific Slope business, under the name of the California Electrical Works.

DOSSERT & COMPANY, 242 West 41st Street, New York, manufacturers of solderless connectors, cable taps, and terminal lugs for electric cables and solid wires, will be represented at the convention of the National Electric Light Association in Chicago by Mr. H. B. Logan, president, and Mr. Charles A. Flynn, M. E. Their exhibit, which will be in space No. 6, will include a number of new devices for central station work and connectors for heavy cables.

FAIRBANKS, MORSE & COMPANY.—The officials of the various branch houses and factories of Fairbanks, Morse & Company in the Middle West held a banquet at the Commercial Club, in Indianapolis, Ind., on the 28th ult. Mayor Bookwalter made a felicitous address, expressing the appreciation of the people of Indianapolis that the company had established an important and extensive electrical factory in the city without the blowing of trumpets or the asking for a subsidy. The officials held an interesting two days' session. Among those in attendance and who took a part in the deliberations were: W. E. Miller, first vice-president; H. C. McClary, second vice-president; F. F. Forbes, purchasing agent; L. J. Osburn, manager of electrical department, and F. E. Benedict, department manager of supplies, all of Chicago; W. B. Wood, Detroit; George B. Woodard and John Snarenberger, Louisville; J. M. D. Robb and H. W. Bonnell, Cincinnati; H. E. Cluekering, Cleveland; E. V. Abbott and S. L. Hadley, of Indianapolis. The officials expressed themselves as being well pleased with their visit and meeting in Indianapolis and will likely meet there again next year.

THE DUNCAN ELECTRIC MANUFACTURING COMPANY is placing on exhibition at the Chicago N. E. L. A. Convention one of its total output station integrating wattmeters, also one of its latest graphic recording instruments, which it claims to be the most accurate and the most simple in use. These two instruments are so combined that the totalizing meter not only integrates or adds up the total output of the plant, but it also actuates the graphic recording instrument, which shows the output on a moving strip of paper. This is the first public exhibition of a system whereby the output of any number of dynamos, irrespective of whether they are direct current, or single or polyphase alternating current, can be conveniently combined so as to show their total output on a single instrument, and is well worthy of the attention of every central station manager who is interested in the latest and most approved methods of keeping an accurate cost of the production of his electrical energy. There will also be on exhibition a number of the latest Duncan house type and switchboard type meters, all of which embody the very latest features in the art. The exhibit will be in charge of Mr. Adrian Tobias, sales manager, and Mr. John A. Clark, laboratory expert.

GENERAL ELECTRIC CONVENTION EXHIBIT.—The exhibit of the General Electric Company at the N. E. L. A. convention in Chicago will occupy a space of some 16 ft. square near the center of the Auditorium Annex. A full line of heating devices, including the new mantel type luminous radiator, will be shown. Prominent among the apparatus exhibited will be tungsten lamps for both interior and outdoor lighting, and the luminous and flame arc lamps. There will also be exhibited the new aluminum cell lightning arrester, a line of meters, both portable and stationary, and a number of alternating and direct-current motors for small power purposes. An oscillograph will be in operation, and records will be taken to show the effect of different values of reactance on the wave form. A daily demonstration of electric cooking devices will be held, and a substantial welcome is assured those who desire to judge the excellence of electrically cooked edibles. Among the representatives of the company at the convention will be the following: E. W. Rice, Jr., J. R. Lovejoy, C. D. Haskins, P. D. Wagoner, F. G. Vaughen, D. R. Bullen, E. E. Gilbert, W. L. R. Emmet, C. W. Stone, N. R. Birge, C. B. Burleigh, C. P. Steinmetz, J. W. Kirkland, Theo. Beran, A. D. Babson, H. J. Buddy, A. D. Page, T. E. Bibbins, F. H. Gale, G. L. Thompson, D. B. Rushmore and F. W. Willcox.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 28, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

885,745. ELECTRIC FURNACE; Paul Girod, Ugine, France. App. filed Dec. 20, 1905. Construction of electric furnace having a chamber with a mass of resistance material arranged in layers in contact with the sides, ends and bottom of the receptacle.

885,754. SYSTEM OF ELECTRICAL DISTRIBUTION; Albert S. Hubbard, Greenwich, Conn., App. filed Jan. 15, 1903. System of distribution having a plurality of prime movers and energy consumption devices driven thereby. Includes a plurality of dynamo electric machines having driving connection with the prime movers, and means for causing the transfer of energy from one dynamo electric machine to another.

885,755. SYSTEM OF ELECTRICAL DISTRIBUTION; Albert S. Hubbard, Belleville, N. J. App. filed Aug. 24, 1905. Distribution system adapted to accommodate and regulate all parts of the system in accordance with changes in the average load occurring during a given period, such as the course of a day, during which the demand is at a light average, and later when the demand is at a heavy average.

885,761. PROCESS OF RECOVERING METALS FROM THEIR SULFID ORES; Edward Frank Kern, Knoxville, Tenn. App. filed Sept. 1, 1906. A process of recovering lead and associated metals from lead sulfid which contains ore, which consists in first fusing said ores with a suitable flux to form a matte and electrolyzing a suitable fused electrolyte with said matte as anode.

885,763. PHYSICAL LABORATORY APPARATUS; Louie E. Knott, Boston, Mass. App. filed Nov. 23, 1907. A laboratory dynamo or generator which can be taken apart and reassembled. Is of the original Gramme type.

885,769. ELEMENT FOR ELECTRIC HEATERS; Abbot A. Low, Horseshoe, and Harry Hertzberg, New York, N. Y. App. filed May 4, 1907. A resistance element for heaters making use of carbon blocks which are held together by an asbestos cord.

885,771. TRANSFORMER COIL INSULATION; Jesse E. Mateer, Wilkinsburg, Pa. App. filed Dec. 16, 1905. Has current carrying parts of unlike potential and means for insulating said parts from each other, comprising a wall of insulating fluid maintained between the parts in which barrier plates of hard insulating material are interposed at regular intervals.

885,776. TROLLEY POLE HEAD; Garret Mott, of New York, N. Y. App. filed April 25, 1907. The trolley wheel is mounted in a section of the trolley pole which is swiveled to the main portion on a vertical axis.

885,782. RHEOSTAT; Granville F. Packard, Pittsburg, Pa. App. filed April 28, 1906. Has a set of contact terminals and a switch arm to engage therewith, together with a doubled resistance strip and means for making continuous circuit connection to both portions thereof.

885,800. COIL SUPPORT FOR ELECTRIC TRANSFORMERS; Herbert C. Soule, Wilkinsburg, Pa. App. filed Aug. 3, 1907. A transformer having a core member and a winding having a plurality of coils which project beyond the ends of the core member, and means independent of the other transformer parts for supporting the projecting ends of the winding.

885,836. INSULATED CANOPY-COLLAR; Thomas H. Bullock, Jr., New York, N. Y. App. filed Aug. 24, 1906. A canopy-collar comprising a ring and a cap having screw threaded connections with each other and forming the two parts of a clamp, and a contractible insulating sleeve contained within said collar and cap, adapted to embrace the metallic tubing of the fixture and to be forced into frictional contact therewith by said clamp.

885,847. ELECTRICAL DISTRIBUTION; John Somerville Highfield, London, England. App. filed Jan. 20, 1908. High-tension, direct-current series system of electrical supply designed to improve the method of distribution whereby greater security in the supply is obtained and greater flexibility of the arrangement to allow of the growth of the system.

885,859. TELEPHONE-STAND; William B. Oliver, Collingswood, N. J. App. filed March 23, 1907. A telephone support, including in combination an adjustable counter-balancing supporting means, a stem comprising a switch box carried by said supporting means, and held from horizontal rotation thereon, a switch hook mounted upon said stem and a transmitter carried by said stem and mounted to rotate with relation thereto in a substantially horizontal plane.

885,864. ELECTRICAL CONNECTION; Henry R. Read, Brooklyn, N. Y. App. filed April 26, 1907. The strands of the conductor are double backed on the outside of the insulation, and a spring sleeve is pushed over this portion of the cable so as to establish electrical contact therewith.

885,882. STARTING DEVICE FOR MERCURY LAMPS; Charles P. Steinmetz, Schenectady, N. Y. App. filed Oct. 17, 1904. In an electric system, the combination of a mercury tube, means for supplying current thereto, a movable member within said tube, a solenoid for operating said movable member, an auxiliary conductive path for supplying current to said solenoid independent of that transmitted by said vapor tube, and means for automatically opening said auxiliary path when the current in said vapor tube has attained substantially its normal value.

885,890. LAMP SOCKET; William C. Tregoning, Cleveland, Ohio. App. filed Aug. 12, 1907. Lamp socket for electric light signs. Makes use of a cylindrical porcelain block having a socket shell and having integral lateral lugs through which the fastening screws are passed.

885,906. ELECTRIC-ARC LAMP; Heinrich Reck, Frankfort-on-the-Main, Germany. In an electric-arc lamp, an apertured frame, an electrode adapted to be fed through the same, and a plurality of sliding frames having apertures of progressively decreasing diameters through which the electrode also passes, said plates free to be moved by the electrode and co-operating to seal the aperture in the frame.

885,915. BUSY-SIGNAL APPARATUS; Charles J. Erickson, Chicago, Ill. App. filed Nov. 12, 1906. An interrupter or buzzer for producing an interrupted current of a relative high-rate vibration, and a second interrupter or buzzer for interrupting the said current at a relatively low rate of vibration.

885,922. TELEPHONE SYSTEM FOR FIRE-HOSE; Harry Grosswith, Philadelphia, Pa. App. filed March 8, 1905. Renewed March 24, 1908. The hose has wires longitudinally embedded therein which terminates in engaging abutments to establish telephone connection. Makes use of clasps to avoid a screw coupling.

885,934. METHOD OF MAKING ARTIFICIAL MICAS; Florentine L. Machalske, Niagara Falls, N. Y. App. filed Nov. 21, 1907. A method of making artificial micas which consists in melting in an electric furnace a charge proportioned to yield a mica.

885,935. RHEOSTAT; Edward L. Mahon, Bellaire, Ohio. App. filed June 6, 1907. Construction of rheostat having a stationary and an adjustable conductor plate and means for interposing a body of water under pressure between the conductor plates.

885,941. ELEVATOR INDICATING SYSTEM; Charles E. Moore, Los Angeles, Cal. App. filed Sept. 3, 1907. Has a visual indicator upon the grill work at each floor or landing, connected with the car and operated by the movement thereof, so as to show in which direction the car is moving.

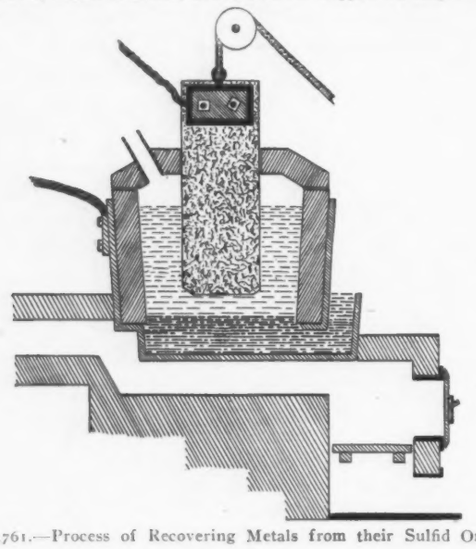
885,942. SAFETY FLASHLIGHT APPARATUS FOR ELEVATORS; Charles E. Moore, Los Angeles, Cal. App. filed Sept. 3, 1907. A

safety flashlight system for an elevator car, comprising a light adapted to flash across the floor of the car at the gateway thereto, electrical connections for said light, and means in combination with the operating lever of the car for automatically lighting said light when the lever is thrown to stop the car.

885,961. CONTROLLING SYSTEM FOR HOISTS; Barton R. Shover, Chicago, Ill., and Arthur C. Eastwood, Cleveland, Ohio. App. filed June 20, 1907. A controlling system analogous to that in use for elevators and adapted to control a hoist motor for blast furnace coal and oil carriers.

885,967. ELECTRIC CONTROLLER; Reuben I. Wright, Cleveland, Ohio. App. filed Oct. 11, 1906. Construction of the contact arm, the finger, and finger holders of a controller. The blow-out magnet is embodied directly in the contact arm and produces a magnetic field across the contacts.

885,978. PREPARATION OF THE INDIGO-VAT EMPLOYED IN DYEING; Henri Chaumat, Paris, France. App. filed Aug. 20, 1907.



885,761.—Process of Recovering Metals from their Sulfid Ores.

Consists in treating an alkaline solution by an electric current in a chamber having a diaphragm with an anode of non-oxidizable metal and a cathode of metallic powder.

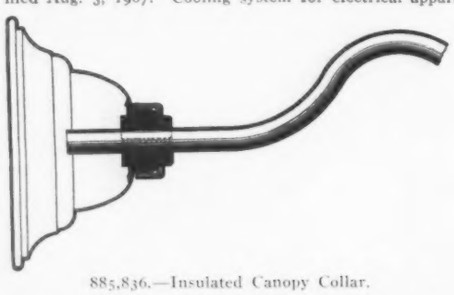
885,988. DUPLEX MOTOR CONTROL SYSTEM; Fred R. Fishback, Cleveland, Ohio. App. filed Sept. 13, 1907. A motor control system for operating a plurality of magnetically operated switch controllers by means of a single handle so that by said handle one or both of the magnetically operated controllers may be actuated.

885,998. DIAPHRAGM AND METHOD OF MAKING THE SAME; Heinrich Hirtz, West Hampstead, Eng. App. filed Oct. 3, 1905. A diaphragm for use in an electrolytic cell, consisting of a suitable textile fabric having deposited within it an insoluble double cyanid.

886,035. DIRECT-CURRENT TURBO-GENERATOR.; Bernard A. Behrend, Norwood, Ohio. App. filed Oct. 31, 1906. In a dynamo-electric machine, an armature core, coils carried thereby, a commutator, a clamping device for said commutator, and a protective end-ring surrounding the ends of the coils and extending inward to said clamping device.

886,049. MULTIPLE-VOLTAGE SYSTEM FOR DISTRIBUTION; Budd Frankfield, Norwood, Ohio. App filed Nov. 30, 1906. In a multiple-voltage system of distribution, main and compensating conductors, a balancer, and a controller for first connecting the balancer to the main conductors and then, after the balancer is up to speed, to a compensating conductor.

886,073. COOLING SYSTEM FOR ELECTRICAL APPARATUS; Karl C. Randall, Edgewood Park, and Charles B. Gibson, Wilkinsburg, Pa. App. filed Aug. 3, 1907. Cooling system for electrical apparatus, pro-



885,836.—Insulated Canopy Collar.

viding means for regulating the circulation of insulating fluid through a plurality of tanks or cases which are connected in multiple and in which transforming or other electrical devices are contained.

886,093. CONTACT POST SYSTEM FOR TRANSMITTING ELECTRIC POWER; George E. Titcomb, Philadelphia, Pa. App. filed Feb. 29, 1908. Specially constructed contact rods depend from spring arms on the body of the car so as to engage stationary contacts at spaced intervals along the side of the track.

886,109. FIELD ADJUSTING DEVICE FOR ELECTRIC GENERATORS AND MOTORS; Frederick Ossian Ball, North Plainfield, N. J. App. filed Jan. 11, 1907. Field adjusting device for electric generators and motors. Includes specially constructed clamping and adjusting irons which are placed beneath the supporting legs of the generator frame.

886,135. WATTMETER TESTING APPARATUS; Otto A. Knopp, Oakland, Cal. App. filed June 10, 1907. Apparatus particularly designed and connected to provide a convenient means for testing recording wattmeters without the necessity of removing them from the various positions in which they may be installed.

886,138.—ELECTRIC IGNITER; John N. Lansinger, Kent, Ohio. App. filed April 24, 1907. Curling iron so arranged that a circuit is completed to heat the prongs thereof when the prongs are in their divergent relation, but not when they spring together in use.

886,141. INTERRUPTER; August R. Luschka, River Forest, Ill. App. filed Dec. 11, 1905. Relates to pole changers for transferring direct current into pulsating or alternating current. Has a magnet operated vibrator which engages the spring blades of a pole changing switch. The apparatus includes resistances and condensers to prevent sparking at the contacts.

886,148. SIGNALING DEVICE FOR INCUBATORS; Georg Mücke, Reisenberg, Austria-Hungary. App. filed Dec. 31, 1907. Has a thermostat connected with an alarm, and a separate thermostat operating a damper for the lamp which furnishes the heat.

886,154. OSCILLATION RECEIVER; Greenleaf Whittier Pickard, Amesbury, Mass. App. filed Sept. 30, 1907. An oscillation receiver or detector making use of a fused mass of oxid of zinc.

886,157. ELECTRICALLY OPERATED CLOCK; Dominic Sandretto, Ladd, Ill. App. filed Nov. 21, 1907. An attachment for ordinary clocks by means of which they may be transformed into electrically operated clocks after having removed the main spring and wheel.

886,169. MEANS FOR ESTABLISHING ELECTRICAL COMMUNICATION WITH MOVING TRAINS; Joel Ames, Montrose, Iowa. App. filed Sept. 16, 1907. The patentee has a specially constructed slider depending from the locomotive tender and which is adapted to engage spiral contact arms projecting upwardly from the ties of the track.

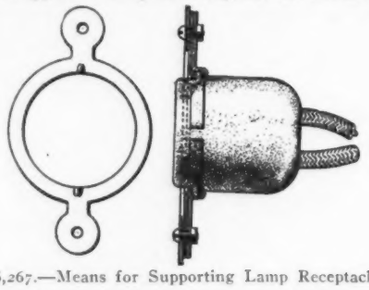
886,176. TROLLEY HARP; Percy C. Bliven, Danielson, Conn. App. filed May 23, 1907. The harp of the pole is made hinged in sections which separate to permit the ready removal of the trolley wheel.

886,220. REGISTERING TELEPHONE CALLS; Eugene Lamar Smith, Oak Cliff, Tex. App. filed June 26, 1907. Means to register a telephonic call, said means comprising a registering device with polarized electromagnet located at the outlying or subscriber's station, and comprising an auxiliary source of current and switching means located at the center, the switching means adjusted to connect said source to the circuit of said outlying station and disconnect said circuit from its normal source of current, said switching device adapted to be manipulated by the operator independent of the means to connect two subscribers' stations with each other.

886,230. RHEOSTAT; John William Mertz, Mount Clemens, Mich. App. filed Jan. 14, 1908. A rheostat having an upper bar and a lower bar with tubular posts connecting said bars together, and resistance windings interposed between said bars. Has electrical connections for said windings, some extending through said tubular posts.

886,239. TROLLEY WHEEL; William W. Neighbour, Denison, Tex. App. filed July 13, 1907. A form of ball bearing for a trolley wheel, having a pair of insulating plates constituting a supporting web for the tread portion and which have run-ways for the balls, so that the current does not pass through the latter. The contact is made by spring cones at the center of the wheel.

886,246. COOLING SYSTEM FOR TRANSFORMERS; Karl C. Randall, Edgewood Park, Pa. App. filed Aug. 3, 1907. Cooling system for electrical apparatus designed to regulate the circulation of insulat-



886,267.—Means for Supporting Lamp Receptacles.

ing and cooling fluid through a plurality of cases which are connected in multiple and in which transformers or other electrical devices are contained.

886,262. SWITCH-CORD PLUG; Eugene L. Smith, Oak Cliff, Tex. App. filed Sept. 1, 1906. A device of the class described, comprising a switch cord and a switch cord plug, the switch cord being provided with a hollow ball secured thereto by a hollow neck and the switch cord plug being provided with a socket adapted to receive said ball, said plug being formed of two semi-cylindrical members rigidly secured together to hold the ball within the socket, and a cylindrical casing surrounding said plug.

886,267. MEANS FOR SUPPORTING LAMP RECEPTACLES; James S. Stewart, New York, N. Y. App. filed April 12, 1907. A form of lamp receptacle or clamp adapted for use for outdoor and interior purposes where the lamps are designed to be fixed to and supported by a base or surface such as an electric sign. The patentee provides a special form of sheet metal clip or stamping, which engages the porcelain body so as to rigidly support the same.

886,269. RAILROAD DANGER SIGNALING AND TELEPHONING APPARATUS; Edward Sughroue, Bartley, Neb. App. filed May 18, 1907. In a signaling system, the combination of a plurality of pyrotechnic signaling devices, mechanical means for igniting each device, and electrical means for simultaneously actuating the mechanical means of the several devices.

886,302. COMBINED TUNING COIL AND CONDENSER; Walter W. Massie, Providence, R. I. App. filed April 3, 1907. Combined tuning coil and condenser. A plurality of segmental plates are fixed to a vertical shaft and swing between fixed segmental plates so as to vary the capacity of the device. Also includes a form of choke coil.

886,303. SPARK GAP APPARATUS; Walter W. Massie, Providence, R. I. App. filed May 2, 1907. Has a rotary spark gap wheel having an arc chamber and also having an inlet leading to and an outlet leading from said chamber, and spark gap rods co-operating with said wheel.

886,319. SUPPORT FOR ELECTRIC CONTACT SHOES; Ed. Wilson Farnham, Chicago, Ill. App. filed Aug. 2, 1905. A means for maintaining the contact shoe of a train in spring-pressed engagement with the under side of the conductor rail. Makes use of spring-impelled link arms depending from the truck frames.